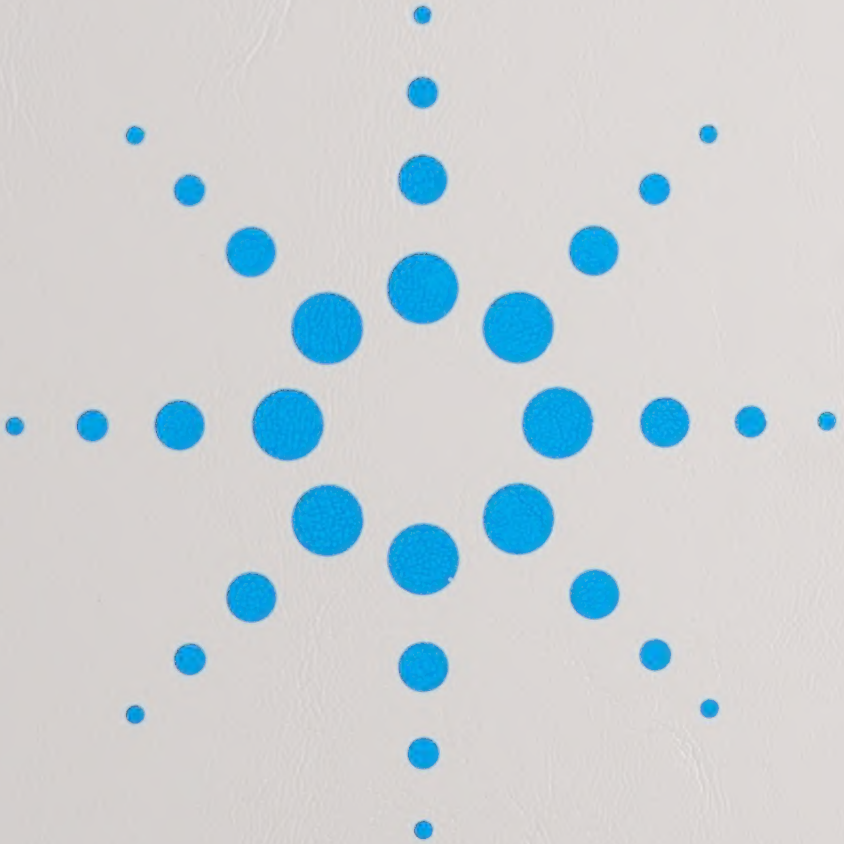

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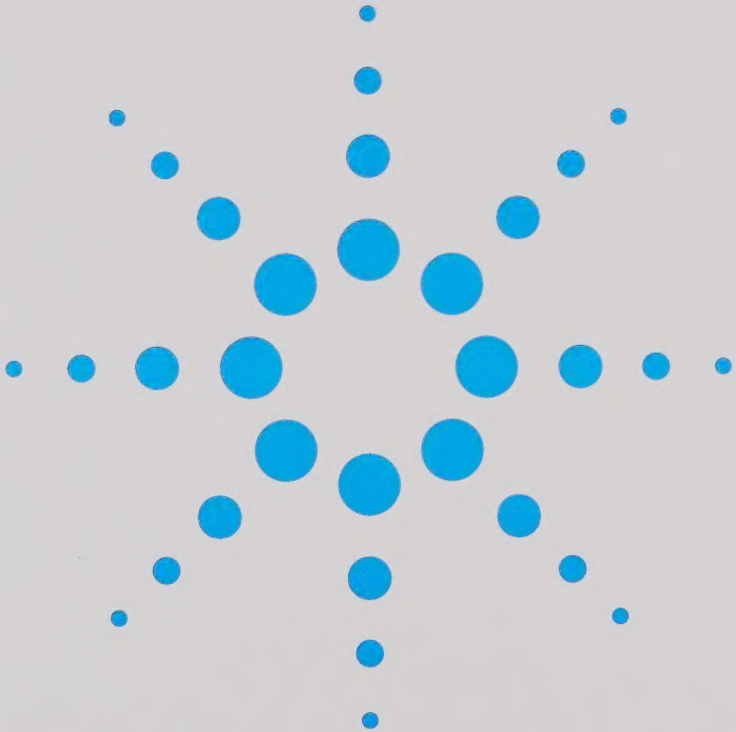
Notice

Hewlett-Packard to Agilent Technologies Transition

This documentation supports a product that previously shipped under the Hewlett-Packard company brand name. The brand name has now been changed to Agilent Technologies. The two products are functionally identical, only our name has changed. The document still includes references to Hewlett-Packard products, some of which have been transitioned to Agilent Technologies.

Agilent Technologies

Printed in USA March 2000



Agilent Technologies

Programming Guide

83711A/12A and 83711B/12B Synthesized CW Generators

HP part number: 83711-90132 Supersedes 5960-7089
Printed in USA April, 1995

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The HP 83711A/12A and HP 83711B/12B Synthesized CW Generators

The HP 83711A/12A and HP 83711B/12B Synthesized CW Generators are referred to as "synthesizers" throughout this manual. The HP 83711A/11B has a carrier frequency range of 1 GHz to 20 GHz and the HP 83712A/12B has a carrier frequency range of 10 MHz to 20 GHz. Complete specification information can be found in Chapter 4 in the *HP 83711A/12A and HP 83711B/12B Synthesized CW Generators User's Guide.*

This programming guide provides specific, detailed information about the commands used to program the synthesizer.

Notes

1. This manual applies to instruments with firmware revision 10.0 or greater.
2. If you have an HP 83711A/12A instrument with firmware revision number < 10.0, refer to the *HP 83711A/12A Synthesized CW Generator Programmer's Reference* (5960-7089).
3. To view firmware revision, press (SPCL), (1), (HZ) (ENTER).

In This Book

This book provides information about the various commands used in programming the synthesizer, error messages, and regulatory information. Information is divided into chapters as follows:

- **Chapter 1,** "Getting Started Programming," contains general HP-IB information, introduces the Standard Commands for Programmable Instruments (SCPI), and provides example programs.
- **Chapter 2,** "Programming Commands," contains entries on all of the programming commands used by the synthesizer. This chapter is subdivided into sections that contain groupings of related commands. For example, all commands related to automatic level control are grouped in one tabbed section.
- **Chapter 3,** "Error Messages," contains a list of all of the error messages that might be generated during use of the instrument. Each entry in the list contains a sequence that can be followed to recover from the error condition.
- **Chapter 4,** "HP 8673 Compatibility Guide," contains HP 8673 to SCPI compatibility information.
- **Chapter 5,** "Legal and Regulatory Information," contains SCPI conformance information. The product warranty is also contained in this chapter.

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1

Getting Started Programming

Getting Started Programming

HP-IB, the Hewlett-Packard Interface Bus, is the instrument-to-instrument communication system between the Synthesizer and up to 14 other instruments. Any instrument having HP-IB capability can be interfaced to the Synthesizer, including non-HP instruments that have "GP-IB," "IEEE-488," "ANSI MC1.1," or "IEC-625" capability (these are common generic terms for HP-IB; all are electrically equivalent although IEC-625 uses a unique connector). This portion of the manual specifically describes interfacing the synthesizer to a computer.

The first part of this chapter provides general HP-IB information. Later, the Standard Commands for Programmable Instruments language (SCPI) is introduced, and example programs are given.

Interconnecting Cables

The HP-IB connector allows the synthesizer to be connected to any other instrument or device on the interface bus. All HP-IB instruments can be connected with HP-IB cables and adapters. These cables are shown in Figure 1-1. The adapters are principally extension devices for instruments that have recessed or crowded HP-IB connectors.

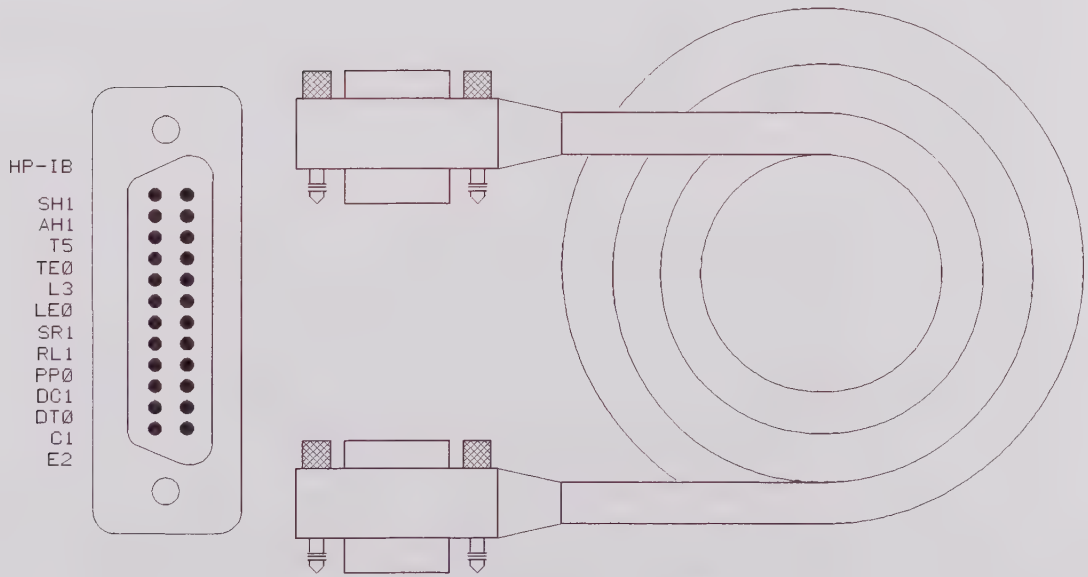


Figure 1-1. HP-IB Connector and Cable

Table 1-1. HP-IB Interface Cables Available

HP-IB Cable Part Numbers	Lengths
HP 10833A	1m (3.3 ft)
HP 10833B	2m (6.6 ft)
HP 10833C	4m (13.2 ft)
HP 10833D	0.5m (1.6 ft)

As many as fourteen HP-IB instruments can be connected to the synthesizer (fifteen total instruments in the system). The cables can be interconnected in a "star" pattern (one central instrument, with the HP-IB cables emanating from that instrument like spokes on a wheel), or in a linear pattern (like boxcars on a train), or any combination pattern. There are certain restrictions:

- Each instrument must have a unique HP-IB address, ranging from 0 to 30 (decimal). Refer to "Instrument Addresses" in this chapter for information on setting the synthesizer's HP-IB address.
- In a two-instrument system that uses just one HP-IB cable, the cable length must not exceed 4 meters (13 ft).
- When more than two instruments are connected on the bus, the cable length to each instrument must not exceed 2 meters (6.5 ft) per unit.
- The total cable length between all units must not exceed 20 meters (65 ft).

Hewlett-Packard manufactures HP-IB extender instruments (HP models 37201A, 37204A/B) that overcome the range limitations imposed by the cabling rules. These extenders allow twin-pair cable operation up to 1 km (3,280 ft), and telephone modem operation over any distance. HP sales and service offices can provide additional information on the HP-IB extenders.

The codes next to the HP-IB connector, illustrated in Figure 1-1, describe the HP-IB electrical capabilities of the synthesizer, using IEEE Std. 488-1978 mnemonics (HP-IB, GP-IB, IEEE-488, and IEC-625 are all electrically equivalent). Briefly, the mnemonics translate as follows:

SH1 Source Handshake, complete capability.

AH1 Acceptor Handshake, complete capability.

T5:	Talker; capable of basic talker, serial poll, and unaddress if MLA.
TE0	Talker, Extended address; no capability.
L3	Listener, capable of basic listener, and unaddress if MTA.
LE0	Listener, Extended address; no capability.
SR1	Service Request, complete capability.
RL1	Remote Local, complete capability.
PP0	Parallel Poll, no capability.
DC1	Device Clear, complete capability.
DT0	Device Trigger, complete capability.
C0, 1	Controller capability options; C0, no capabilities; C1, system controller.
E2	Electrical specification indicating open collector outputs.

These codes are described completely in the IEEE Std. 488-1978 document, published by the Institute of Electrical and Electronic Engineers, Inc., 345 East 47th Street, New York, New York 11017.

Instrument Addresses

Each instrument in an HP-IB network must have a unique address, an integer ranging in value from 0 to 30. The default address for the synthesizer is 19, but this can be changed using the (SHIFT) (LOCAL) keys.

HP-IB Instrument Nomenclature

An HP-IB instrument is categorized as a "listener," "talker," or "controller," depending on its current function in the network.

Listener

A listener is a device capable of receiving data or commands from other instruments. Any number of instruments in the HP-IB network can be listeners simultaneously.

Talker

A talker is a device capable of transmitting data or commands to other instruments. To avoid confusion, an HP-IB system allows only one device at a time to be an active talker.

Controller

A controller is an instrument, typically a computer, capable of managing the various HP-IB activities. Only one device at a time can be an active controller.

Programming the Synthesizer

The synthesizer can be controlled entirely by a computer (although the POWER or LINE switch must be operated manually). Several functions are possible only by computer (remote) control. Computer programming procedures for the synthesizer involve selecting an HP-IB command statement, then adding the specific synthesizer (SCPI, HP 8673) programming codes to that statement to achieve the desired operating conditions.

In the programming explanations that follow, specific examples are included that are written in a generic dialect of the BASIC language. BASIC was selected because the majority of HP-IB computers have BASIC language capability. However, other programming languages can also be used.

HP-IB Command Statements

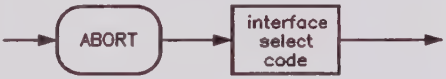
Command statements form the nucleus of HP-IB programming; they are understood by all instruments in the network and, when combined with the programming language codes, they provide all management and data communication instructions for the system.

An explanation of the eight fundamental command statements follows. However, some computers use a slightly different terminology, or support an extended or enhanced version of these commands. Consider the following explanations as a starting point, but for detailed information consult the BASIC language reference manual, the I/O programming guide, and the HP-IB manual for the particular computer used.

Syntax drawings accompany each statement: All items enclosed by a circle or oval are computer specific terms that must be entered exactly as described; items enclosed in a rectangular box are names of parameters used in the statement; and the arrows indicate a path that generates a valid combination of statement elements.

Abort

Abort abruptly terminates all listener/talker activity on the interface bus, and prepares all instruments to receive a new command from the controller. Typically, this is an initialization command used to place the bus in a known starting condition. The syntax is:



where the interface select code is the computer's HP-IB I/O port, which is typically port 7. Some BASIC examples:

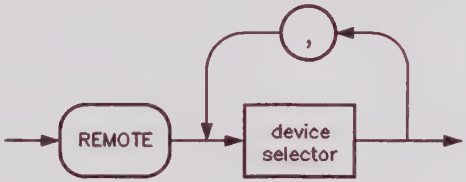
```
10    ABORT 7

100   IF V>20 THEN ABORT 7
```

Related statements used by some computers

- ABORTIO (used by HP-80 series computers)
- HALT
- RESET

Remote

Remote causes an instrument to change from local control to remote control. In remote control, the front panel keys are disabled (except for the LOCAL key and the POWER or LINE switch), and the REMOTE annunciator is lit. The syntax is:



where the device selector is the address of the instrument appended to the HP-IB port number. Typically, the HP-IB port number is 7, and the default address for the synthesizer is 19, so the device selector is 719.

Some BASIC examples

```
10   REMOTE 7
```

which prepares all HP-IB instruments for remote operation (although nothing appears to happen to the instruments until they are addressed to talk), or

```
10   REMOTE 719
```

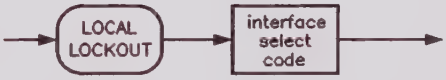
which affects the HP-IB instrument located at address 19, or

```
10   REMOTE 719, 721, 726, 715
```

which effects four instruments that have addresses 19, 21, 26, and 15.

Local Lockout

LOCAL LOCKOUT can be used in conjunction with REMOTE to disable the front panel (LOCAL) key. With the (LOCAL) key disabled, only the controller (or a hard reset by the POWER switch) can restore local control. The syntax is:

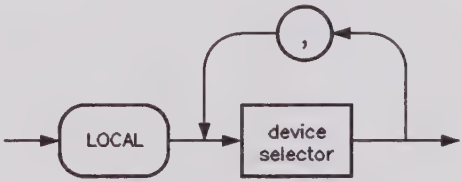


A BASIC example

```
10    REMOTE 719
20    LOCAL LOCKOUT 7
```

Local

LOCAL is the complement to REMOTE, causing an instrument to return to local control with a fully enabled front panel. The syntax is:



Some BASIC examples

```
10    LOCAL 7
```

which effects all instruments in the network, or

```
10    LOCAL 719
```

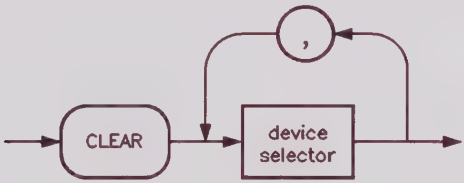
for an addressed instrument (address 19).

Clear

CLEAR causes all HP-IB instruments, or addressed instruments, to assume a "cleared" condition, with the definition of "cleared" being unique for each device. For the synthesizer:

1. All pending output-parameter operations are halted.
2. The parser (the software that interprets the programming codes) is reset, and now expects to receive the first character of a programming code.

The syntax is:



Some BASIC examples

```
10    CLEAR 7
```

to clear all HP-IB instruments, or

```
10    CLEAR 719
```

to clear an addressed instrument.

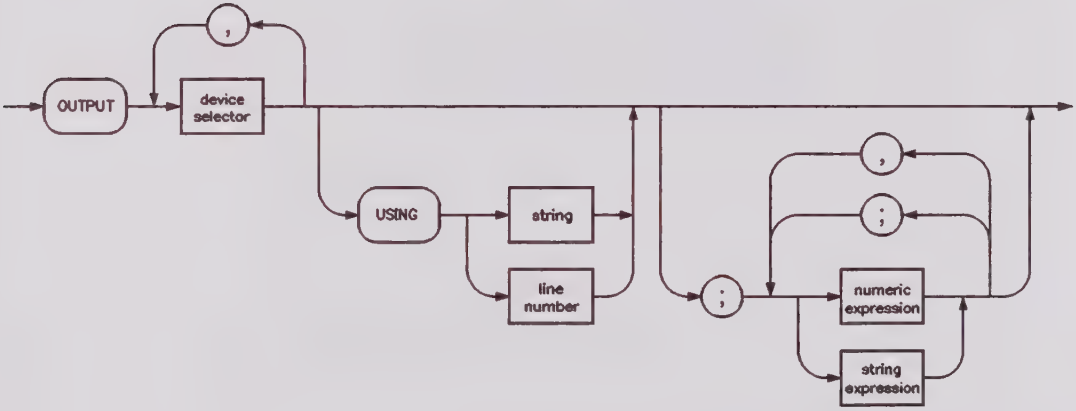
Related statements used by some computers

- RESET
- CONTROL
- SEND

The preceding statements are primarily management commands that do not incorporate programming codes. The following two statements do incorporate programming codes, and are used for data communication.

Output

OUTPUT is used to send function commands and data commands from the controller to the addressed instrument. The syntax is:



where USING is a secondary command that formats the output in a particular way, such as a binary or ASCII representation of numbers. The USING command is followed by "image items" that precisely define the format of the output; these image items can be a string of code characters, or a reference to a statement line in the computer program. Image items are explained in the programming codes where they are needed. Notice that this syntax is virtually identical to the syntax for the ENTER statement that follows.

A BASIC example

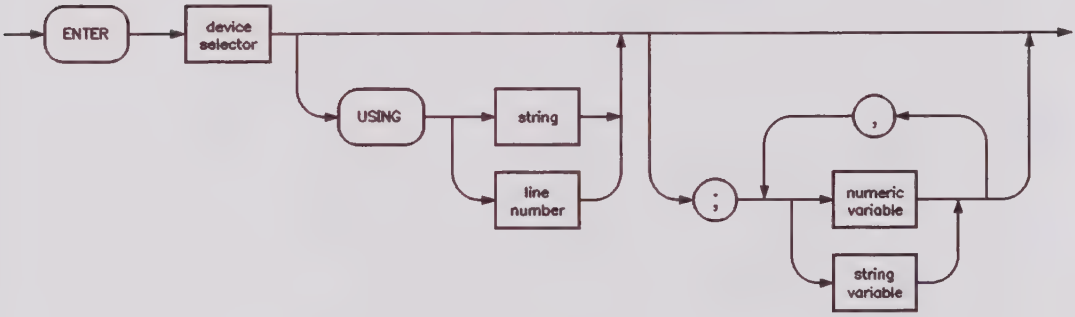
```
100  OUTPUT 719; "programming codes"
```

Related statements used by some computers

- CONTROL
- CONVERT
- IMAGE
- IOBUFFER
- TRANSFER

Enter

ENTER is the complement of OUTPUT, and is used to transfer data from the addressed instrument to the controller. The syntax is:



ENTER is always used in conjunction with OUTPUT, such as:

```
100   OUTPUT 719; " ... programming codes ... "
110   ENTER 719; " ... response data ... "
```

ENTER statements are commonly formatted, which requires the secondary command USING and the appropriate image items. The most-used image items involve end-of-line (end or identify) suppression, binary inputs, and literal inputs.

Example

```
100   ENTER 719 USING "#, B"; A, B, C
```

suppresses the EOI sequence (#), and indicates that variables A, B, and C are to be filled with binary (B) data. As another example,

```
100   ENTER 719 USING "#, 123A"; A$
```

suppresses EOI, and indicates that string variable A$ is to be filled with 123 bytes of literal data (123A).

NOTE

Be careful when using byte-counting image specifiers. If the requested number of bytes does not match the actual number available, data might be lost, or the program might enter an endless wait state.

The suppression of the EOI sequence is frequently necessary to prevent a premature termination of the data input. When not specified, the typical EOI termination occurs when an ASCII LF (line feed) is received. However, the LF bit pattern could coincidentally occur randomly in a long string of binary data, where it might cause a false termination. Also, the bit patterns for the ASCII CR (carriage return), comma, or semicolon might cause a false termination. Suppression of the EOI causes the computer to accept all bit patterns as data, not commands, and relies on the HP-IB EOI (end or identify) line for correct end-of-data termination.

Related statements used by some computers

- CONVERT
- IMAGE
- IOBUFFER
- ON TIMEOUT
- SET TIMEOUT
- TRANSFER

This completes the "HP-IB Command Statements" subsection. The following material explains the SCPI programming codes, and shows how they are used with the OUTPUT and ENTER HP-IB command statements.

Getting Started with SCPI

This section of Chapter 1 describes the use of the Standard Commands for Programmable Instruments language (SCPI). This section explains how to use SCPI commands in general. This section presents only the basics of SCPI. If you want to explore the topic in greater depth, see the paragraph titled, "Related Documents."

Definitions of Terms

You need a general understanding of the terms listed below before you continue.

controller — A controller is any computer used to communicate with a SCPI instrument. A controller can be a personal computer, a minicomputer, or a plug-in card in a card cage. Some intelligent instruments can also function as controllers.

instrument — An instrument is any device that implements SCPI. Most instruments are electronic measurement or stimulus devices, but this is not a requirement. Similarly, most instruments use an HP-IB interface for communication. The same concepts apply regardless of the instrument function or the type of interface used.

program message — A program message is a combination of one or more properly formatted SCPI commands. Program messages always go from a controller to an instrument. Program messages tell the instrument how to make measurements and output signals.

response message — A response message is a collection of data in specific SCPI formats. Response messages always go from an instrument to a controller or listening instrument. Response messages tell the controller about the internal state of the instrument and about measured values.

command — A command is an instruction in SCPI. You combine commands to form messages that control instruments. In general, a command consists of mnemonics (keywords), parameters, and punctuation.

query — A query is a special type of command. Queries instruct the instrument to make response data available to the controller. Query mnemonics always end with a question mark.

Standard Notation

This section uses several forms of notation that have specific meaning.

Command Mnemonics

Many commands have both a long and a short form, and you must use either one or the other (SCPI does not accept a combination of the two). Consider the `FREQuency` command,for example. The short form is `FREQ` and the long form is `FREQUENCY` (this notation style is a shorthand to document both the long and short form of commands). SCPI is not case sensitive, so `fREquEnCy` is just as valid as `FREQUENCY`, but `FREQ` and `FREQUENCY` are the only valid forms of the `FREQuency` command.

Angle Brackets

Angle brackets indicate that the word or words enclosed represent something other than themselves. For example, `<new line>` represents the ASCII character with the decimal value 10. Similarly, `<^END>` means that EOI is asserted on the HP-IB interface. Words in angle brackets have much more rigidly defined meaning than words used in ordinary text. For example, this section uses the word "message" to talk about messages generally. But the bracketed words `<program message>` indicate a precisely defined element of SCPI. If you need them, you can find the exact definitions of words such as `<program message>` in a syntax diagram.

How to Use Examples

It is important to understand that programming with SCPI actually requires knowledge of two languages. You must know the programming language of your controller (BASIC, C, Pascal) as well as the language of your instrument (SCPI). The semantic requirements of your controller's language determine how the SCPI commands and responses are handled in your application.

Command Examples

Command examples look like this:

```
:FREQuency:CW?
```

This example tells you to put the string `:FREQuency:CW?` in the output statement appropriate to your application programming language. If you encounter problems, study the details of how the output statement handles message terminators such as `<new line>`. If you are using simple `OUTPUT` statements in HP BASIC, this is taken care of for you. In HP BASIC, you type:

```
OUTPUT 719;":FREQuency:CW?"
```

Command examples do not show message terminators because they are used at the end of every program message. "Details of Commands and Responses," discusses message terminators in more detail.

Response Examples

Response examples look like this:

```
3.000000000000E+009
```

These are the characters you would read from an instrument after sending a query command. To actually pull them from the instrument into the controller, use the input statement appropriate to your application programming language. If you have problems, study the details of how the input statement operates. In particular, investigate how the input statement handles punctuation characters such as comma and semicolon, and how it handles `<new line>` and EOI. To enter the previous response in HP BASIC, you type:

```
ENTER 719;CW_frequency
```

Response examples do not show response message terminators because they are always `<new line> <^END>`. These terminators are typically automatically handled by the input statement. The paragraph titled "Details of Commands and Responses," later in this chapter, discusses message terminators in more detail.

Essentials for Beginners

This section discusses elementary concepts critical to first-time users of SCPI. Read and understand this section before continuing. This section includes the following topics:

Program and Response Messages	These paragraphs introduce the basic types of messages sent between instruments and controllers.
Subsystem Command Trees	These paragraphs describe the tree structure used in subsystem commands.
Reading Instrument Errors	These paragraphs explain how to read and print an instrument's internal error messages.
Example Programs	These paragraphs contain two simple measurement programs that illustrate basic SCPI programming principles.

Program and Response Messages

To understand how your instrument and controller communicate using SCPI, you must understand the concepts of program and response messages. *Program messages* are the formatted data sent from the controller to the instrument. Conversely, *response messages* are the formatted data sent from the instrument to the controller. Program messages contain one or more commands, and response messages contain one or more responses.

The controller may send commands at any time, but the instrument sends responses only when specifically instructed to do so. The special type of command used to instruct the instrument to send a response message is the *query*. All query mnemonics end with a question mark. Queries return either measured values or internal instrument settings. Any internal setting that can be programmed with SCPI can also be queried.

Forgiving Listening and Precise Talking

SCPI uses the concept of forgiving listening and precise talking outlined in IEEE 488.2.

Forgiving listening means that instruments are very flexible in accepting various command and parameter formats. For example, the synthesizer accepts either `:POWer:STATe ON` or `:POWer:STATe 1` to turn RF output on.

Precise talking means that the response format for a particular query is always the same. For example, if you query the power state when it is on (using `:POWer:STATe?`), the response is always `1`, regardless of whether you previously sent `:POWer:STATe 1` or `:POWer:STATe ON`.

Types of Commands

Commands can be separated into two groups, common commands and subsystem commands.

Common commands are generally not measurement related. They are used to manage macros, status registers, synchronization, and data storage. Common commands are easy to recognize because they all begin with an asterisk, such as `*IDN?`, `*OPC`, and `*RST`. Common commands are defined by IEEE 488.2.

Subsystem commands include all measurement functions and some general purpose functions. Subsystem commands are distinguished by the colon used between keywords, as in `:FREQuency:CW?`. Each command subsystem is a

set of commands that roughly corresponds to a functional block inside the instrument. For example, the `POWer` subsystem contains commands for power generation, while the `STATus` subsystem contains commands for accessing status registers.

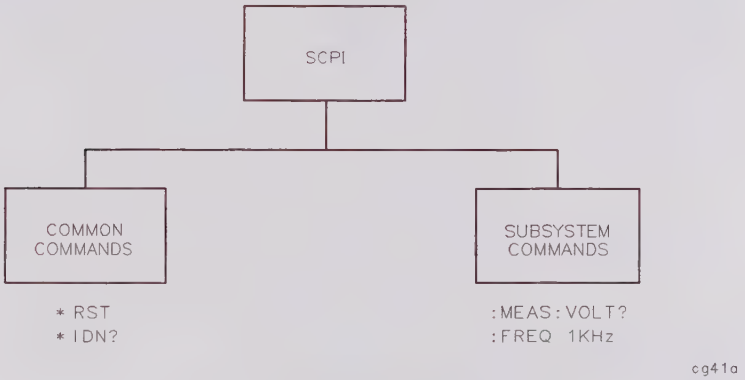


Figure 1-2. SCPI Command Types

The remaining paragraphs in this subsection discuss subsystem commands in more detail. Remember, some commands are implemented in one instrument and not in another, depending on its measurement function.

Subsystem Command Trees

The Command Tree Structure

Most programming tasks involve subsystem commands. SCPI uses a hierarchical structure for subsystem commands similar to the file systems on most computers. In SCPI, this command structure is called a *command tree.*

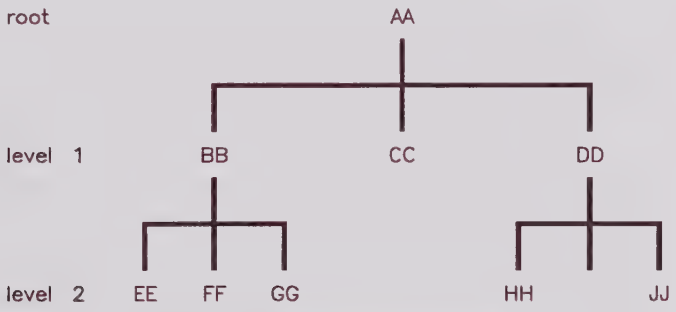


Figure 1-3. A Simplified Command Tree

In the command tree shown in Figure 1-3, the command closest to the top is the *root command*, or simply the *root*. Notice that you must follow a particular *path* to reach lower level subcommands. For example, if you wish to access the `GG` command, you must follow the path `AA` to `BB` to `GG`.

Paths Through the Command Tree

To access commands in different paths in the command tree, you must understand how an instrument interprets commands. A special part of the instrument firmware, a *parser*, decodes each message sent to the instrument. The parser breaks up the message into component commands using a set of rules to determine the command tree path used. The parser keeps track of the *current path*, the level in the command tree where it expects to find the next command you send. This is important because the same keyword may appear in different paths. The particular path you use determines how the keyword is interpreted. The following rules are used by the parser:

- *Power On and Reset*

  After power is cycled or after *RST, the current path is set to the root.

- *Message Terminators*

  A message terminator, such as a **<new line>** character, sets the current path to the root. Many programming languages have output statements that send message terminators automatically. The paragraph titled, "Details of Commands and Responses," later in this chapter, discusses message terminators in more detail.

- *Colon*

  When it is between two command mnemonics, a colon moves the current path down one level in the command tree. For example, the colon in **MEAS:VOLT** specifies that **VOLT** is one level below **MEAS**. When the colon is the first character of a command, it specifies that the next command mnemonic is a root level command. For example, the colon in **:INIT** specifies that **INIT** is a root level command.

- *Semicolon*

  A semicolon separates two commands in the same message without changing the current path.

- *Whitespace*

  Whitespace characters, such as **<tab>** and **<space>**, are generally ignored. There are two important exceptions. Whitespace inside a keyword, such as **:FREQ uency**, is not allowed. You must use white space to separate parameters from commands. For example, the **<space>** between **LEVel** and **6.2** in the command **:POWer:LEVel 6.2** is mandatory. Whitespace does not affect the current path.

- *Commas*

  If a command requires more than one parameter, you must separate adjacent parameters using a comma. Commas do not affect the current path.

- *Common Commands*

  Common commands, such as ***RST**, are not part of any subsystem. An instrument interprets them in the same way, regardless of the current path setting.

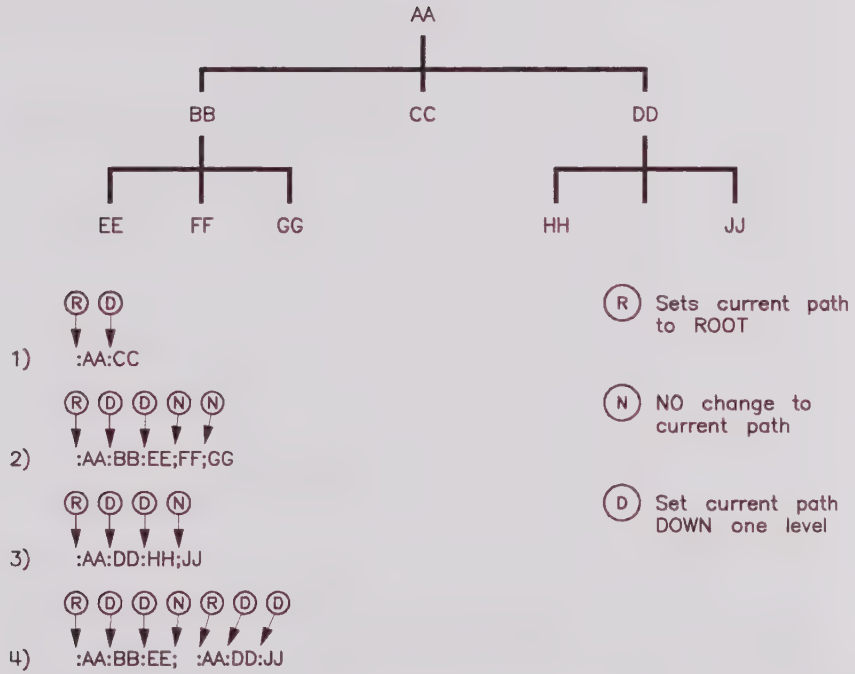


Figure 1-4. Proper Use of the Colon and Semicolon

Figure 1-4 shows examples of how to use the colon and semicolon to navigate efficiently through the command tree. Notice how proper use of the semicolon can save typing.

Sending this message:

```
:AA:BB:EE; FF; GG
```

Is the same as sending these three messages:

```
:AA:BB:EE

:AA:BB:FF

:AA:BB:GG
```

More About Commands

Query and Event Commands

You can query any value that you can set. For example, the presence of the synthesizer `FREQuency:STEP` command implies that a `FREQuency:STEP?` also exists. If you see a command ending with a question mark, it is a *query* only command. Some commands are *events*, and cannot be queried. An event has no corresponding setting if it causes something to happen inside the instrument at a particular instant.

Implied Commands

Implied commands appear in square brackets. If you send a subcommand immediately preceding an implied command, but do not send the implied command, the instrument assumes you intend to use the implied command, and behaves just as if you had sent it. Note that this means the instrument expects you to include any parameters required by the implied command. The following example illustrates equivalent ways to program the synthesizer using explicit and implied commands.

Example Synthesizer commands with and without an implied command:

```
FREQuency:STEP:INCRement 1    using explicit commands
FREQuency:STEP 1              using implied commands
```

Optional Parameters

Optional parameter names are enclosed in square brackets. If you do not send a value for an optional parameter, the instrument chooses a default value. The instrument's command dictionary documents the values used for optional parameters.

Program Message Examples

The following parts of the synthesizer SCPI command set will be used to demonstrate how to create complete SCPI program messages:

```
:FREQuency
   [:CW]
        :STEP
:POWER
   [:LEVel]
```

Example 1

`"FREQuency:CW 5 GHZ; STEP 2 GHZ"`

The command is correct and will not cause errors. It is equivalent to sending:

`"FREQuency:CW 5 GHZ; :FREQuency:STEP 2 GHZ".`

Example 2

`"FREQuency 5 GHZ; :STEP 2 GHZ"`

This command results in a command error. The command makes use of the default [:CW] node. When using a default node, there is no change to the current path position. Since there is no command `"STEP"` at the root, an error results. A correct way to send this is:

`"FREQ 5 GHZ; FREQ:STEP 2 GHZ"`

or as in example 1.

Example 3

```
"FREQuency:STEP 1 GHZ; FREQuency:CW 5 GHZ"
```

This command results in a command error. The FREQ:CW portion of the command is missing a leading colon. The path level is dropped at each colon until it is in the FREQ:STEP subsystem. So when the FREQ:CW command is sent, it causes confusion because no such node occurs in the FREQ:STEP subsystem. By adding a leading colon, the current path is reset to the root. The corrected command is:

```
"FREQuency:STEP 1 GHZ; :FREQuency:CW 5 GHZ".
```

Example 4

```
"FREQ 5 GHZ;  POWER 4 DBM"
```

Notice that in this example the keyword short form is used. The command is correct. It utilizes the default nodes of [:CW] and [:LEVEL]. Since default nodes do not affect the current path, it is not necessary to use a leading colon before POWER.

Reading Instrument Errors

When debugging a program, you may want to know if an instrument error has occurred. Some instruments can display error messages on their front panels. If your instrument cannot do this, you can put the following code segment in your program to read and display error messages.

```
 10 !
 20 !  The rest of your
 30 ! variable declarations
 40 !  Assign @box to 719
 50 DIM Err_msg$[75]
 60 INTEGER Err_num
 70 !
 80 ! Part of your program
 90 ! that generates errors
100 !
110 !
200 REPEAT
210   OUTPUT @Box;":SYST:ERR?"
220   ! Query instrument error
230   ENTER @Box;Err_num,Err_msg$
240   ! Read error #, message
250   PRINT Err_num,Err_msg$
260   ! Print error message
270 UNTIL Err_num = 0
280 ! Repeat until no errors
290 !
300 !  The rest of your program
310 !
```

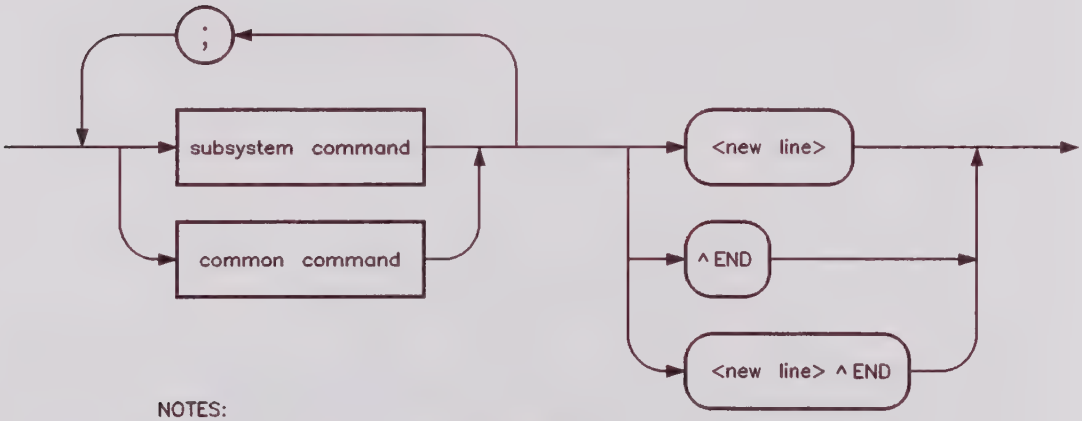
Details of Commands and Responses

This section describes the syntax of SCPI commands and responses. It provides many examples of the data types used for command parameters and response data. The following topics are explained:

Program Message Syntax	These paragraphs explain how to properly construct the messages you send from the computer to instruments.
Response Message Syntax	These paragraphs discuss the format of messages sent from instruments to the computer.
SCPI Data Types	These paragraphs explain the types of data contained in program and response messages.

Program Message Syntax

These program messages contain commands combined with appropriate punctuation and program message terminators.



NOTES:

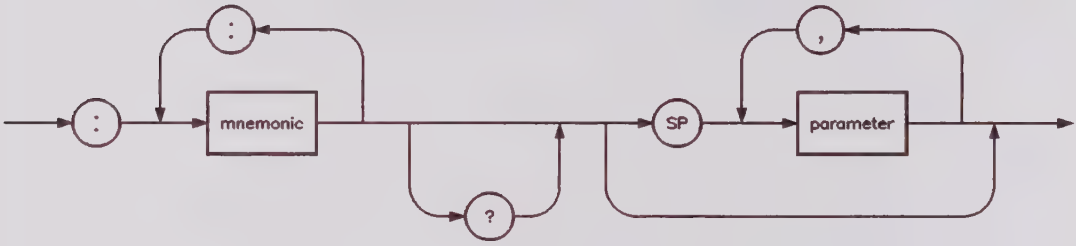
<new line> = ASCII character decimal 10

^END = EOI asserted concurrent with last byte

Figure 1-5. Simplified Program Message Syntax

As Figure 1-5 shows, you can send common commands and subsystem commands in the same message. If you send more than one command in the same message, you must separate them with a semicolon. You must always end a program message with one of the three program message terminators shown in Figure 1-5. Use `<new line>`, `<^END>`, or `<new line> <^END>` as the program message terminator. The word `<^END>` means that EOI is asserted on the HP-IB interface at the same time the preceding data byte is sent. Most programming languages send these terminators automatically. For example, if you use the HP BASIC `OUTPUT` statement, `<new line>` is automatically sent after your last data byte. If you are using a PC, you can usually configure the system to send whatever terminator you specify.

SCPI Subsystem Command Syntax

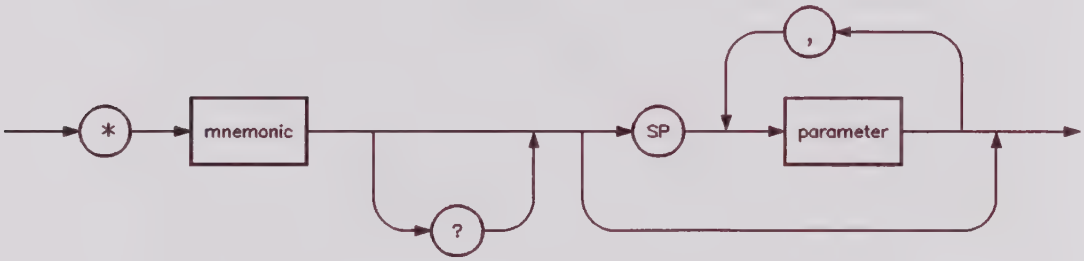


NOTE:
SP = white space, ASCII characters 0_{10} to 9_{10} and 11_{10} to 32_{10}

Figure 1-6. SCPI Simplified Subsystem Command Syntax

As Figure 1-6 shows, there must be a <space> between the last command mnemonic and the first parameter in a subsystem command. This is one of the few places in SCPI where <space> is required. Note that if you send more than one parameter with a single command, you must separate adjacent parameters with a comma. Parameter types are explained later in this subsection.

Common Command Syntax



NOTE:
SP = white space, ASCII characters 0_{10} to 9_{10} and 11_{10} to 32_{10}

Figure 1-7. Simplified Common Command Syntax

As with subsystem commands, use a <space> to separate a command mnemonic from subsequent parameters. Separate adjacent parameters with a comma. Parameter types are explained later in this subsection.

Response Message Syntax

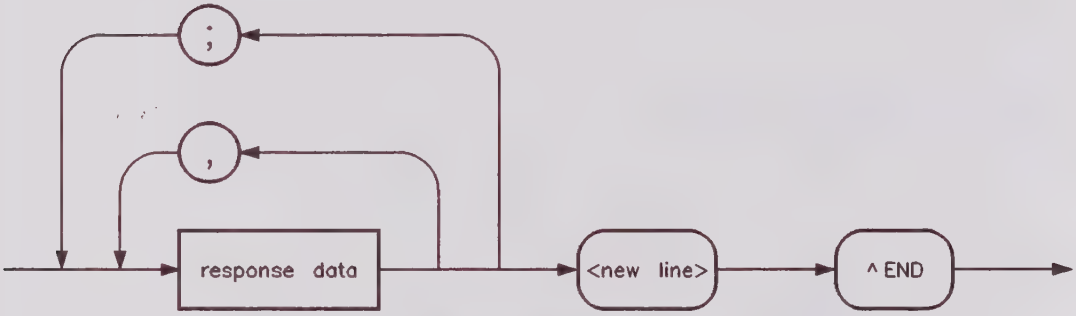


Figure 1-8. Simplified Response Message Syntax

Response messages can contain both commas and semicolons as separators. When a single query command returns multiple values, a comma separates each data item. When multiple queries are sent in the same message, the groups of data items corresponding to each query are separated by a semicolon. For example, the fictitious query `:QUERY1?:QUERY2?` might return a response message of:

```
<data1>,<data1>;<data2>,<data2>
```

Response data types are explained later in this subsection. Note that `<new line><^END>` is always sent as a response message terminator.

SCPI Data Types

These paragraphs explain the data types available for parameters and response data. They list the types available and present examples for each type. SCPI defines different data formats for use in program messages and response messages. It does this to accommodate the principle of forgiving listening and precise talking. Recall that forgiving listening means instruments are flexible, accepting commands and parameters in various formats. Precise talking means an instrument always responds to a particular query in a predefined, rigid format. Parameter data types are designed to be flexible in the spirit of forgiving listening. Conversely, response data types are defined to meet the requirements of precise talking.

Table 1-2. SCPI Data Types

Parameter Types	Response Data Types
Numeric	Real or Integer
Extended Numeric	Integer
Discrete	Discrete
Boolean	Numeric Boolean
String	String
Block	Definite Length Block
	Indefinite Length Block
Non-decimal Numeric	Hexadecimal
	Octal
	Binary

Notice that each parameter type has one or more corresponding response data types. For example, a setting that you program using a numeric parameter returns either real or integer response data when queried. Whether real or integer response data is returned depends on the instrument used. However, precise talking requires that the response data type be clearly defined for a particular instrument and query. The instrument command

dictionary in Chapter 2 generally contains information about data types for individual commands. The following paragraphs explain each parameter and response data type in more detail.

Parameter Types

Numeric Parameters

Numeric parameters are used in both subsystem commands and common commands. Numeric parameters accept all commonly used decimal representations of numbers including optional signs, decimal points, and scientific notation.

If an instrument setting programmed with a numeric parameter can only assume a finite number of values, the instrument automatically rounds the parameter. For example, if an instrument has a programmable output impedance of 50 or 75 ohms, and you specified `76.1` for output impedance, the value is rounded to `75`. If the instrument setting can only assume integer values, it automatically rounds the value to an integer. For example, sending `*ESE 10.123` is the same as sending `*ESE 10`.

Examples of numeric parameters:

`100`	*no decimal point required*
`100.`	*fractional digits optional*
`-1.23`	*leading signs allowed*
`4.56e<space>3`	*space allowed after e in exponentials*
`-7.89E-01`	*use either E or e in exponentials*
`+256`	*leading + allowed*
`.5`	*digits left of decimal point optional*

Extended Numeric Parameters

Most subsystems use *extended numeric* parameters to specify physical quantities. Extended numeric parameters accept all numeric parameter values and other special values as well. All extended numeric parameters accept **MAXimum** and **MINimum** as values. Other special values, such as **UP** and **DOWN** may be available as documented in Chapter 2. Note that **MINimum** and **MAXimum** can be used to set or query values. The query forms are useful for determining the range of values allowed for a given parameter.

In some instruments, extended numeric parameters accept engineering unit suffixes as part of the parameter value.

Note that extended numeric parameters are not used for common commands or **STATus** subsystem commands.

Examples of extended numeric parameters:

```
100.              any simple numeric values
-1.23             largest valid setting
4.56e<space>3
-7.89E-01
+256
.5

MAX
MIN               valid setting nearest negative infinity
-100 mV           negative 100 millivolts
```

Discrete Parameters

Use *discrete parameters* to program settings that have a finite number of values. Discrete parameters use mnemonics to represent each valid setting. They have a long and a short form, just like command mnemonics. You can used mixed upper and lower case letters for discrete parameters.

Examples of discrete parameters used with the ALC:SOURce subsystem:

`INTernal`	*internal leveling*
`DIODe`	*external diode detector leveling*

Although discrete parameters values look like command keywords, do not confuse the two. In particular, be sure to use colons and spaces properly. Use a colon to separate command mnemonics from each other. Use a space to separate parameters from command mnemonics.

Examples of discrete parameters in commands:

```
100 OUTPUT @Source;"POWer:ALC:SOURce INT"
100 OUTPUT @Source;"POWer:ALC:SOURce DIODe"
```

Boolean Parameters

Boolean parameters represent a single binary condition that is either true or false. There are only four possible values for a Boolean parameter.

Examples of Boolean parameters:

`ON`	*Boolean TRUE, upper/lower case allowed*
`OFF`	*Boolean FALSE, upper/lower case allowed*
`1`	*Boolean TRUE*
`0`	*Boolean FALSE*

Response Data Types

Real Response Data

A large portion of all measurement data are formatted as *real* response data. Real response data are decimal numbers in either fixed decimal notation or scientific notation. In general, you do not need to worry about the rules for formatting real data, or whether fixed decimal or scientific notation is used. Most high level programming languages that support instrument I/O handle either type transparently.

Examples of real response data:

```
  1.23E+0
 -1.0E+2
 +1.0E+2
  0.5E+0
  1.23
-100.0
+100.0
  0.5
```

Integer Response Data

Integer response data are decimal representations of integer values including optional signs. Most status register related queries return integer response data.

Examples of integer response data:

```
  0   signs are optional
+100  leading + sign allowed
-100  leading sign allowed
 256  never any decimal point
```

Discrete Response Data

Discrete response data are similar to discrete parameters. The main difference is that discrete response data return only the short form of a particular mnemonic, in all upper case letters.

Examples of discrete response data:

```
INTernal    level internally
DIODe       level using an external diode
```

String Response Data

String response data are similar to string parameters. The main difference is that string response data use only double quotes as delimiters, rather than single quotes. Embedded double quotes may be present in string response data. Embedded quotes appear as two adjacent double quotes with no characters between them.

Examples of string response data:

```
"This IS valid"
"SO IS THIS "" "
"I said, ""Hello!"""
```

Programming Typical Measurements

This section illustrates how the general SCPI concepts presented in previous sections apply to programming real measurements. To introduce you to programming with SCPI, we must list the commands for the synthesizer. We will begin with a simplified example.

Using the Example Programs

The example programs are interactive. They require active participation by the operator. If you desire to get an understanding of the principles without following all of the instructions, read the "Program Comments" paragraphs to follow the programmed activity.

The HP-IB select code is assumed to be preset to 7. All example programs in this section expect the synthesizer's HP-IB address to be decimal 19.

To find the present HP-IB address use the front panel.

Press (SHIFT) (LOCAL).

The active entry area indicates the present decimal address. If the number displayed is not 19, press (19) (ENTER) to reset it to 19.

Now check that the interface language is set to SCPI. Press (SPECIAL) (15) (ENTER). The selected interface language is then shown, use the up and down keys to change the language.

HP-IB Check, Example Program 1

This first program is to verify that the HP-IB connections and interface are functional. Connect a controller to the synthesizer via an HP-IB cable. Clear and reset the controller and type in the following program:

```
10   Synthesizer =719
20   ABORT 7
30   LOCAL Synthesizer
40   CLEAR Synthesizer
50   REMOTE Synthesizer
60   CLS
70   PRINT "The synthesizer should now be in REMOTE."
80   PRINT "Verify that the 'RMT' annunciator is on."
90   END
```

Run the program and verify that the RMT annunciator is lit on the synthesizer. If it is not, verify that the synthesizer address is set to 19 and that the interface cable is properly connected.

If the controller display indicates an error message, it is possible that the program was entered in incorrectly. If the controller accepts the REMOTE statement but the synthesizer RMT annunciator does not turn on, refer to the service guide to find the trouble shooting information.

Program Comments

10: Set up a variable to contain the HP-IB address of the source.

20: Abort any bus activity and return the HP-IB interfaces to their reset states.

30: Place the synthesizer into LOCAL to cancel any Local Lockouts that may have been setup.

40: Reset the synthesizer's parser and clear any pending output from the source. Prepare the synthesizer to receive new commands.

50: Place the synthesizer into REMOTE.

60: Clear the display of the computer.

70: Print a message to the computer's display.

Local Lockout Demonstration, Example Program 2

When the synthesizer is in REMOTE mode, all the front panel keys are disabled except the LOCAL key. But, when the LOCAL LOCKOUT command is set on the bus, even the LOCAL key is disabled. The LOCAL command, executed from the controller, is then the only way to return all (or selected) instruments to front panel control.

Continue example program 1. Delete line 90 END and type in the following commands:

```
90   PRINT "Verify that all keys are ignored,
            except the 'LOCAL' key."
100  PRINT "Verify that 'LOCAL' causes the
            RMT annunciator to go OFF."
110  PRINT " ..... press CONTINUE"
120  PAUSE
130  REMOTE Synthesizer
140  LOCAL LOCKOUT 7
150  PRINT
160  PRINT "Synthesizer should now be in LOCAL LOCKOUT mode."
170  PRINT "Verify that all keys (including 'LOCAL')
            have no effect."
180  PRINT " ..... press CONTINUE"
190  PAUSE
200  LOCAL Synthesizer
210  PRINT
220  PRINT "Synthesizer should now be in LOCAL mode."
230  PRINT "Verify that the synthesizer's keyboard
            is functional."
240  END
```

Program Comments

90 to 120:	Print a message on the computer's display, then pause.
130:	Place the synthesizer into REMOTE.
140:	Place the synthesizer into LOCAL LOCKOUT mode.
150 to 190:	Print a message on the computer's display, then pause.
200:	Return the synthesizer to local control.
210 to 230:	Print a message on the computer's display.

Internally Leveled CW Signal, Example Program 3

In the following example, an internally leveled, CW signal is generated at a frequency of 2.000203 GHz with a power level of −2.1 dBm. Clear and reset the controller and type in the following program:

```
10   Synthesizer=719
20   ABORT 7
30   LOCAL 7
40   CLEAR Synthesizer
50   REMOTE Synthesizer
60   OUTPUT Synthesizer;"*RST"
70   OUTPUT Synthesizer;"POW:ALC:SOUR INT"
80   OUTPUT Synthesizer;"FREQuency 2.000203GHZ"
90   OUTPUT Synthesizer;"POWer:LEVel -2.1 DBM"
100 OUTPUT Synthesizer;"OUTP:STATe ON"
110 END
```

Run the program.

Program Comments

10:	Assign the synthesizer's HP-IB address to a variable.
20 to 50:	Abort any HP-IB activity and initialize the HP-IB interface.
60:	Set the synthesizer to its initial state for programming. The *RST state is the same as the PRESET state.
70:	Enable internal leveling.
80:	Set the frequency to 2.000203 GHz.
90:	Set the synthesizer's power level to −2.1 dBm.
100:	Turn the RF output on.

Level Correction Routine, Example Program 4

The following example demonstrates how to gather level correct data externally, then load the collected data into one of the synthesizer level correct tables. Clear and reset the controller and type in the following program:

```
10    Synthesizer=719
20    Power_meter=713
30    ABORT 7
40    LOCAL 7
50    CLEAR Synthesizer
60    REMOTE Synthesizer
70    CLS
80    OUTPUT Synthesizer;"*RST"
90    OUTPUT Power_meter;"*RST"
100   DIM Frequencies(1:401)
110   DIM Losses(1:401)
120   PRINT "CHOOSE THE START FREQUENCY IN GHZ (1.654321 FOR
          EXAMPLE)"
130   ENTER KBD;Start_freq
140   PRINT "CHOOSE THE STOP FREQUENCY IN GHZ (15.123456 FOR
          EXAMPLE)"
150   ENTER KBD;Stop_freq
160   PRINT "CHOOSE THE NUMBER OF POINTS (2 TO 401)"
170   ENTER KBD;Points
180   PRINT "CHOOSE THE LEVEL CORRECTION TABLE TO STORE DATA
          INTO (1 TO 4)"
190   ENTER KBD;Table_num
200   PRINT "CHOOSE THE SYNTHESIZER POWER LEVEL TO USE
          DURING ";
210   PRINT "THE LEVEL CORRECTION"
220   PRINT "(-3.32 FOR EXAMPLE)"
230   ENTER KBD;Power_level
240   OUTPUT Synthesizer; "POW ";Power_level
250   OUTPUT Power_meter; "FM 32 EN"
260   OUTPUT Power_meter; "TRO"
270   Step_freq=(Stop_freq-Start_freq)/(Points-1)
280   Current_freq=Start_freq
```

```
290  FOR I=1 TO Points
300           Frequencies(I)=Current_freq
310           OUTPUT Synthesizer; "FREQ ";Current_freq;" GHZ"
320           OUTPUT Power_meter; "FR ";Current_freq;" GZ"
330           OUTPUT Power_meter; "TR2"
340            WAIT 5
350            ENTER Power_meter;Meter_reading
360            Losses(I)=Power_level-Meter_reading
370            Current_freq=Current_freq+Step_freq
380  NEXT I
390  OUTPUT Synthesizer; "MEM:TABL:SEL
            FDAT";TRIM$(VAL$(Table_num))
400  !
410  !  Store frequencies
420  !
430  OUTPUT Synthesizer; "MEM:TABL:FREQ ";
440  FOR I=1 TO Points
450           OUTPUT Synthesizer;Frequencies(I);"GHZ";
460           IF I<Points THEN OUTPUT Synthesizer;",";
470  NEXT I
480  OUTPUT Synthesizer USING "/"
490  !
500  !  Store losses
510  !
520  OUTPUT Synthesizer; "MEM:TABL:LOSS ";
530  FOR I=1 TO Points
540           OUTPUT Synthesizer;Losses(I);
550           IF I<Points THEN OUTPUT Synthesizer;",";
560  NEXT I
570  OUTPUT Synthesizer USING "/"
580  PRINT "END OF PROGRAM"
590  END
```

Run the program.

Program Comments

10:	Assign the synthesizer's HP-IB address to a variable.
20:	Assign the power meter's HP-IB address to a variable.
30 to 60:	Abort any HP-IB activity and initialize the HP-IB interface.
70:	Clear the computer's display.

80:	Set the synthesizer to its initial state for programming.
90:	Set the power meter to its initial state for programming.
100:	Dimension frequency array.
110:	Dimension correction factor array.
120:	Print a message on the computer display for entering the start frequency.
130:	Enter start frequency into variable Start_freq.
140:	Print a message on the computer display for entering the stop frequency.
150:	Enter stop frequency into variable Stop_freq.
160:	Print a message for entering the number of frequency points to measure.
170:	Enter number of measurement points into variable Points.
180:	Print a message on the computer display for entering the desired correction table number.
190:	Enter correction table number into variable Table_num.
200 to 220:	Print a message on the computer display for entering the power level.
230:	Enter power level into variable Power_level.
240:	Set Synthesizer's power level to the entered value.
250:	Set number of averages.
260:	Set power meter to trigger hold mode.
270:	Calculate the frequency step.
280:	Set variable Current_freq equal to the start frequency set by variable Start_freq.
300:	Store current frequency into the Frequencies array.
310:	Set Synthesizer to the current frequency.
320:	Set power meter frequency to the current frequency.
330:	Set power meter to trigger with delay.

340: Wait five seconds for power meter to stabilize.

350: Enter current power meter reading into variable Meter_reading.

360: Store the correction factor into the Losses array.

370: Increment the current frequency to the next frequency point to measure.

390: Select a table for data storage.

430: Command the synthesizer to load the following frequency points into table.

450: Add a frequency point into the table.

460: Add a data separator (comma).

480: Add a line feed.

520: Command the synthesizer to load the following correction factors into table.

540: Add a correction factor into the table.

550: Add a data separator (comma).

570: Add a line feed.

Saving and Recalling States, Example Program 5

The complete front panel state may be saved for later use in non-volatile memories called registers 0 through 9. This can be done remotely as a part of a program. Clear and reset the controller and type in the following program:

```
10   Synthesizer=719
20   ABORT 7
30   LOCAL 7
40   CLEAR Synthesizer
50   REMOTE Synthesizer
60   CLS
70   OUTPUT Synthesizer;"*RST;FREQ: 4GHZ;POW:LEV -3DBM
              ;OUTP:STAT ON"
80   OUTPUT Synthesizer;"*SAV 1"
90   CLS
100  PRINT "A Synthesizer state has been saved in REGISTER 1."
110  OUTPUT Synthesizer;"*RST;FREQ:CW 1.23456GHZ;:POW:LEV -1DBM"
120  OUTPUT Synthesizer;"*SAV 2"
130  PRINT "A CW state has been saved in REGISTER 2."
140  PRINT "..... Press Continue"
150  PAUSE
160  OUTPUT Synthesizer;"*RCL 1"
170  PRINT "Register 1 recalled. Verify Synthesizer output power."
180  PRINT "Press Continue."
190  PAUSE
200  OUTPUT Synthesizer;"*RCL 2"
210  PRINT "Register 2 recalled."
220  PRINT "Verify Synthesizer is in CW mode."
230  END
```

Run the program.

Program Comments

10: Assign the synthesizer's HP-IB address to a variable.

20 to 50: Abort any HP-IB activity and initialize the HP-IB interface.

60: Clear the computer's display.

70: Set up a Synthesizer state. Note the combination of several commands into a single message. This single line is equivalent to the following lines :

```
OUTPUT Synthesizer;"*RST"
OUTPUT Synthesizer;"FREQ 4GHZ"
OUTPUT Synthesizer;"POW:LEV -3DBM"
OUTPUT Synthesizer;"OUTP:STAT ON"
```

80: Save this state into storage register 1.

90: Clear the computer display.

100: Print a message on the computer display.

110: Setup the synthesizer for a CW state. Note the combination of several commands into a single message. This single line is equivalent to the following lines :

```
OUTPUT Source;"*RST"
OUTPUT Source;"FREQ:CW 1.23456 GHZ"
OUTPUT Source;"POW:LEV -1DBM"
```

120: Save this state into storage register 2.

130 to 150: Print a message on the computer display and pause.

160: Recall the instrument state from register 1.

170 to 190: Print a message on the computer display and pause.

200: Recall the instrument state from register 2. It should contain the CW state.

210 and 220: Print messages on the computer display.

IEEE Standard 488.1-1987, IEEE Standard Digital Interface for Programmable Instrumentation. The International Institute of Electrical and Electronics Engineers, New York, NY, 1987.

This standard defines the technical details required to design and build an HP-IB interface (IEEE 488.1). This standard contains electrical specifications and information on protocol that is beyond the needs of most programmers. However, it can be useful to clarify formal definitions of certain terms used in related documents.

IEEE Standard 488.2-1987, IEEE Standard Codes, Formats, Protocols, and Common Commands For Use with ANSI/IEEE Std 488.1-1987. The International Institute of Electrical and Electronics Engineers, New York, NY, 1987.

This document describes the underlying message formats and data types used in SCPI. It is intended more for instrument firmware engineers than for instrument user/programmers. However, you may find it useful if you need to know the precise definition of certain message formats, data types, or common commands.

NOTE

To obtain a copy of either of these documents, write to:

The Institute of Electrical and Electronics Engineers, Inc. 345 East 47th Street New York, NY 10017 USA

BASIC 5.0/5.1 Interfacing Techniques. Vol. 2, Specific Interfaces. Hewlett-Packard Company 1987.

This HP BASIC manual contains a good non-technical description of the HP-IB (IEEE 488.1) interface in Chapter 12, "The HP-IB Interface." Subsequent revisions of HP BASIC may use a slightly different title for this manual or

chapter. This manual is the best reference on instrument I/O for HP BASIC programmers.

Tutorial Description of the Hewlett-Packard Interface Bus Hewlett-Packard Company, 1987

This book provides a thorough overview of HP-IB basics for the HP-IB system designer, programmer, or user.

NOTE

To obtain a copy of either of these documents, contact the Hewlett-Packard representative listed in your telephone directory.

Standard Commands for Programmable Instruments (SPCI)
This document defines the Standard Commands for Programmable Instruments (SPCI) Consortium's SCPI standards.

NOTE

To obtain the above document, contact:

SCPI Consortium
8380 Hercules Drive, Suite P3
La Mesa, CA 91942
Phone: (619) 697-8790
FAX: (619) 697-5955
CompuServe: 76516,254

2

Programming Commands

Programming Commands

This chapter contains detailed information on all the programming commands used by the synthesizer. The chapter is sub-divided into logical groupings of commands that are tabbed. For example, all programming commands pertaining to automatic level control are contained in one tabbed section. The individual commands are organized alphabetically within each section. The remainder of this chapter introduction contains information that pertains to all programming commands. The programming command entries begin with the tab labeled "Automatic Level Control Commands" and end with the tab labeled "Status Register Commands."

Following the heading for each programming command entry is a syntax statement showing the proper syntax for the command. An example syntax statement is shown below:

```
[SOURce[1]:]POWer[:LEVel][:IMMediate][:AMPLitude]
:STEP[:INCRement] { incr | MAXimum | MINimum | DEFault }
```

Syntax statements read from left to right and top to bottom. In the above example, the "`:STEP`" portion of the statement immediately follows the "`[:AMPLitude]`" portion of the statement with no separating space. A separating space is legal only between the command and its argument. In the above example, the portion following the "`[:INCRement]`" portion of the statement is the argument. Additional conventions used in the syntax statements are defined as follows:

- *italics* are used to symbolize a program code parameter or query response.
- ::= means "is defined as".
- | (vertical bar) indicates a choice of one element from a list. For example, <A> | <B> indicates <A> or <B> but not both.
- ... (an ellipsis) is used to indicate that the preceding element may be repeated one or more times.
- [ ] (square brackets) indicate that the enclosed items are optional.
- { } (braces) indicate that one and only one of the enclosed elements must be selected.
- Uppercase Lettering (**FREQuency**) indicates that the uppercase portion of the command is the minimum required for the command.
- Lowercase Lettering (**FREQuency**) indicates that the lowercase portion of the command is optional; it can either be included with the uppercase portion of the command or omitted.

Automatic Level Control Commands

Automatic Level Control Commands

This sub-chapter contains detailed information on all programming commands pertaining to automatic level control.

[SOURce[1]:]POWer:ALC:PMETer

```
[SOURce[1]:]POWer:ALC:PMETer[:LEVel][:AMPLitude]
{ pmeter  }
{ MAXimum }
{ MINimum }
{ UP      }
{ DOWN    }
{ DEFault }
```

The "[SOURce[1]:]POWer:ALC:PMETer" command is used to enter the initial reading of the external power meter to the synthesizer for use during external power meter leveling.

The parameters are as follows:

pmeter	Enters the initial reading of the external power meter to the synthesizer. The allowable range for the parameter is −120 dBm (−100 dBm for HP 83711A/12A) to +30 dBm when option 1E1 is installed or −15 dBm to +30 dBm if option 1E1 is not installed.
MAXimum	Sets the initial power meter reading to its maximum allowable value.
MINimum	Sets the initial power meter reading to its minimum allowable value.
UP	Increases the entered initial power meter reading by the current increment value.
DOWN	Decreases the entered initial power meter reading by the current increment value.
DEFault	Sets the initial power meter reading to its default (preset) value.

The power meter reading set with the "[SOURce[1]:]POWer:ALC:PMETer" command allows the synthesizer to calculate the value of the voltage present at the power meter Recorder Output connector.

If an initial power meter reading is entered that is outside of its allowable range, an error message will be generated and the parameter will be set to either its maximum or minimum limit. The preset value for the parameter is 0 dBm.

Query Syntax

```
[SOURce[1]:]POWer:ALC:PMETer[:LEVel][:AMPLitude]?
[MAXimum]
[MINimum]
[DEFault]
```

Returned format:

pmeter<NL>

Where:

- *pmeter* ::= The current entered initial power meter reading if no argument is specified.
- *pmeter* ::= The maximum initial power meter reading that can be set if the MAXimum argument is specified.
- *pmeter* ::= The minimum initial power meter reading that can be set if the MINimum argument is specified.
- *pmeter* ::= The default (preset) initial power meter reading if the DEFault argument is specified.

See Also

[SOURce[1]:]POWer:ALC:PMETer:STEP
[SOURce[1]:]POWer:ALC:SOURce
UNIT:POWer|:VOLTage

[SOURce[1]:]POWer:ALC:PMETer:STEP

[SOURce[1]:]POWer:ALC:PMETer[:LEVel]:STEP[:INCRement]
{ *incr* | MAXimum | MINimum | DEFault }

The "[SOURce[1]:]POWer:ALC:PMETer:STEP" command selects the increment value for the entered initial power meter reading.

The parameters are as follows:

incr	Sets the increment value for the initial power meter reading. The allowable range for the parameter is 0.01 dB to 130 dB when option 1E1 is installed or 0.01 dB to 45 dB if option 1E1 is not installed.
MAXimum	Sets the increment value for the initial power meter reading to its maximum allowable value.
MINimum	Sets the increment value for the initial power meter reading to its minimum allowable value.
DEFault	Sets the increment value for the initial power meter reading to its default (preset) value.

When the "UP" or "DOWN" parameters are used with the "[SOURce[1]:]POWer:ALC:PMETer" command, the initial power meter reading will be increased or decreased by a step size set with the "[SOURce[1]:]POWer:ALC:PMETer:STEP" command.

Numeric power meter reading increment value entries have a resolution of 0.01 dB.

If an initial power meter reading increment value entry is made that is not within the allowable parameter range, an error message will be generated and it will be set to either its maximum or minimum limit. The preset value for the initial power meter reading increment value is 1 dB.

Query Syntax

```
[SOURce[1]:]POWer:ALC:PMETer[:LEVel]:STEP[:INCRement]?
[MAXimum]
[MINimum]
[DEFault]
```

Returned format:

incr<NL>

Where:

- *incr* ::= The current power meter reading increment value if no argument is specified.
- *incr* ::= The maximum power meter reading increment value that can be set if the MAXimum argument is specified.
- *incr* ::= The minimum power meter reading increment value that can be set if the MINimum argument is specified.
- *incr* ::= The default (preset) power meter reading increment value if the DEFault argument is specified.

See Also

[SOURce[1]:]POWer:ALC:PMETer
UNIT:POWer|:VOLTage

[SOURce[1]:]POWer:ALC:SOURce

[SOURce[1]:]POWer:ALC:SOURce { INTernal | DIODe | PMETer }

The "[SOURce[1]:]POWer:ALC:SOURce" command selects the type of leveling for output power automatic level control.

The parameters are as follows:

INTernal	Selects internal leveling.
DIODe	Selects external diode detector leveling.
PMETer	Selects external power meter leveling.

The (EXT DIODE) (diode detector leveling), (EXT METER) (power meter leveling), and (INT LEVEL) (internal leveling) entries in chapter 6 of the *HP 83711A/12A and HP 83711B/12B Synthesized CW Generators User's Guide* provide detailed information on the type of leveling you select.

When the synthesizer is set to the preset state, internal leveling is selected.

Query Syntax

[SOURce[1]:]POWer:ALC:SOURce?

Returned format:

source<NL>

Where:

- *source* ::= "INT" if internal leveling is currently selected.
- *source* ::= "DIOD" if external diode detector leveling is currently selected.
- *source* ::= "PMET" if external power meter leveling is currently selected.

See Also

EXT DIODE
EXT METER
INT LEVEL
[SOURce[1]:]POWer:ALC:PMETer
[SOURce[1]:]POWer[:LEVel]
To Use External Diode Detector Leveling
To Use External Power Meter Leveling

Carrier Commands

Carrier Commands

This sub-chapter contains detailed information on all programming commands pertaining to carrier control

[SOURce[1]:]FREQuency[:CW|:FIXed]

[SOURce[1]:]FREQuency[:CW|:FIXed] { *freq* | MAXimum | MINimum | UP | DOWN | DEFault }

The "[SOURce[1]:]FREQuency[:CW|:FIXed]" command sets the output frequency of the synthesizer.

The parameters are as follows:

freq	Sets the synthesizer output frequency.
MAXimum	Sets the synthesizer output frequency to the maximum allowable value.
MINimum	Sets the synthesizer output frequency to the minimum allowable value.
UP	Increases the synthesizer output frequency by the current output frequency increment value.
DOWN	Decreases the synthesizer output frequency by the current output frequency increment value.
DEFault	Sets the synthesizer output frequency to its default (preset) value.

The frequency entered is the CW frequency if no modulation is chosen, or the carrier frequency of any modulation type that is chosen. The preset value for the frequency parameter is 3 GHz.

The allowable range for the frequency parameter is 1.0 GHz to 20 GHz for the HP 83711A/11B or 0.01 GHz to 20 GHz for the HP 83712A/12B. If a frequency parameter entry is made that is outside the allowable range, an error message will be generated and the actual frequency will be set to either its upper or lower limit. Frequency resolution is 1 kHz. If Option 1E8 is installed, frequency resolution is 1 Hz.

Query Syntax

```
[SOURce[1]:]FREQuency[:CW|:FIXed]? [MAXimum|MINimum|DEFault]
```

Returned format:

freq<NL>

Where:

- *freq* ::= The current output frequency if no argument is specified.
- *freq* ::= The maximum output frequency that can be set if the MAXimum argument is specified.
- *freq* ::= The minimum output frequency that can be set if the MINimum argument is specified.
- *freq* ::= The default (preset) output frequency if the DEFault argument is specified.

See Also

[SOURce[1]:]FREQuency[:CW|:FIXed]:STEP
[SOURce[1]:]FREQuency:MULTiplier
UNIT:FREQuency

[SOURce[1]:]FREQuency[:CW|:FIXed]:STEP

[SOURce[1]:]FREQuency[:CW|:FIXed]:STEP[:INCRement]
{ *incr* | MAXimum | MINimum | DEFault }

The "[SOURce[1]:]FREQuency[:CW|:FIXed]:STEP" command selects the increment value for the synthesizer output frequency.

The parameters are as follows:

incr	Sets the increment value for output frequency. The allowable range (without option 1E8) for the parameter is 1 kHz to 19.99 GHz. If option 1E8 is installed, the allowable range for the parameter is 1 Hz to 19.99 GHz.
MAXimum	Sets the output frequency increment value to its maximum allowable value.
MINimum	Sets the output frequency increment value to its minimum allowable value.
DEFault	Sets the output frequency increment value to its default (preset) value.

When the "UP" or "DOWN" parameters are used with the "[SOURce[1]:]FREQuency[:CW|:FIXed]" command, the output frequency will be increased or decreased by the step size set with the "[SOURce[1]:]FREQuency[:CW|:FIXed]:STEP" command.

If an output frequency increment value entry is made that is not within the allowable parameter range, an error message will be generated and the incremental value will be set to either its maximum or minimum limit. The preset value for the output frequency increment value is 100 MHz.

Query Syntax

```
[SOURce[1]:]FREQuency[:CW|:FIXed]:STEP[:INCRement]?
[MAXimum]
[MINimum]
[DEFault]
```

Returned format:

incr<NL>

Where:

- *incr* ::= The current output frequency increment value if no argument is specified.
- *incr* ::= The maximum output frequency increment value that can be set if the MAXimum argument is specified.
- *incr* ::= The minimum output frequency increment value that can be set if the MINimum argument is specified.
- *incr* ::= The default (preset) output frequency increment value if the DEFault argument is specified.

See Also

[SOURce[1]:]FREQuency[:CW|:FIXed]
UNIT:FREQuency

[SOURce[1]:]FREQuency:MULTiplier

[SOURce[1]:]FREQuency:MULTiplier { *mult* | MAXimum | MINimum | UP | DOWN | DEFault }

The "[SOURce[1]:]FREQuency:MULTiplier" command sets the multiplier value so that the synthesizer display will indicate the frequency at the output of an external frequency multiplier.

The parameters are as follows:

mult	Sets the multiplier value. The allowable range for the parameter is 1 to 100.
MAXimum	Sets the multiplier value to its maximum allowable value.
MINimum	Sets the multiplier value to its minimum allowable value.
UP	Increases the multiplier value by the current multiplier value increment value.
DOWN	Decreases the multiplier value by the current multiplier value increment value.
DEFault	Sets the multiplier value to its default (preset) value.

If a frequency multiplier value is entered that is out of range, an error message will be generated and the parameter will be set to either its maximum or minimum limit. The preset value for the multiplier value is 1.

Entering a frequency multiplier value is useful when an output frequency will be generated with external multiplier equipment. *Setting the multiplier value scales the display so that the frequency shown on the display will be the frequency at the output of the external frequency multiplier, not at the synthesizer* RF OUTPUT *connector.*

When the multiplier function is being used and you enter a frequency parameter value with the "[SOURce[1]:]FREQuency[:CW|:FIXed]" command,

be aware that the entered frequency divided by the multiplier value (the frequency before multiplication) has a minimum resolution of 1 kHz (1 Hz for Option 1E8). As an example, assume a multiplier value of 2 has been entered and you attempt to enter a frequency of 4,000,001,000 Hz. The actual frequency that the synthesizer would need to generate would be 2,000,000,500 Hz. The synthesizer, however, can not output this signal because the standard specified resolution is 1 kHz. In this case, the actual output frequency would be rounded to 2,000,001,000 Hz and the display would show 4,000,002,000 Hz.

Query Syntax

[SOURce[1]:]FREQuency:MULTiplier? [MAXimum | MINimum | DEFault]

Returned format:

mult<NL>

Where:

- *mult* ::= The current multiplier value if no argument is specified.
- *mult* ::= The maximum multiplier value that can be set if the MAXimum argument is specified.
- *mult* ::= The minimum multiplier value that can be set if the MINimum argument is specified.
- *mult* ::= The default (preset) multiplier value if the DEFault argument is specified.

See Also

[SOURce[1]:]FREQuency[:CW|:FIXed]
[SOURce[1]:]FREQuency:MULTiplier:STEP
To Generate Millimeter Signals

[SOURce[1]:]FREQuency:MULTiplier:STEP

[SOURce[1]:]FREQuency:MULTiplier:STEP[:INCRement]
{ *incr* | MAXimum | MINimum | DEFault }

The "[SOURce[1]:]FREQuency:MULTiplier:STEP" command selects the increment value for the external frequency multiplier value.

The parameters are as follows:

incr	Sets the multiplier increment value. The allowable range for the parameter is 1 to 99.
MAXimum	Sets the multiplier increment value to its maximum allowable value.
MINimum	Sets the multiplier increment value to its minimum allowable value.
DEFault	Sets the multiplier increment value to its default (preset) value.

When the "UP" or "DOWN" parameters are used with the "[SOURce[1]:]FREQuency:MULTiplier" command, the multiplier value will be increased or decreased by a step size set with the "[SOURce[1]:]FREQuency:MULTiplier:STEP" command.

If a multiplier increment value entry is made that is not within its allowable parameter range, an error message will be generated and it will be set to either its maximum or minimum limit. The preset value for the multiplier increment value is 1.

Query Syntax

```
[SOURce[1]:]FREQuency:MULTiplier:STEP[:INCRement]?
[MAXimum]
[MINimum]
[DEFault]
```

Returned format:

incr<NL>

Where:

- *incr* ::= The current multiplier increment value if no argument is specified.
- *incr* ::= The maximum multiplier increment value that can be set if the MAXimum argument is specified.
- *incr* ::= The minimum multiplier increment value that can be set if the MINimum argument is specified.
- *incr* ::= The default (preset) multiplier increment value if the DEFault argument is specified.

See Also

[SOURce[1]:]FREQuency:MULTiplier

Instrument Information Commands

Instrument Information Commands

This sub-chapter contains detailed information on all programming commands pertaining to instrument-specific information.

*IDN? (Identification Query)

```
*IDN?
```

The "*IDN?" query returns a string that contains the instrument model number, serial number, and firmware revision number.

When the "*IDN?" query is received by the instrument, it returns the following string:

```
HEWLETT-PACKARD,8371XX,ser no,REVXX.Y
```

Where HP 8371XX is the instrument model number (either HP 83711A/12A or HP 83711B/12B), "ser no" is the instrument serial number, and "XX.Y" is the firmware revision number.

Note that "*IDN?" should always be the last query in a command line.

*OPT? (Option Identification Query)

```
*OPT?
```

The "*OPT?" query returns a list of the synthesizer option numbers.

In response to the "*OPT?" query, the synthesizer will return a string in the following form:

```
option#1,option#2,option#3,.....option#n,
```

The possible Synthesizer options returned with this command are shown in the following table. If the synthesizer contains none of the options stated in the following table, "0" will be returned.

Synthesizer Options

Option Number	Description
1E1	Add step attenuator.
1E5	Add high stability timebase.
1E8	Add 1 Hz Frequency Resolution.
1E9	3.5 mm RF Output connector.

OUTPut:IMPedance?

```
OUTPut:IMPedance? [MAXimum]
                  [MINimum]
                  [DEFault]
```

The "OUTPut:IMPedance?" query returns the output impedance of the synthesizer RF OUTPUT connector.

NOTE

The synthesizer output impedance is not selectable, therefore, "+5.0000000000000E+001" will always be returned in response to this query. This query is provided for SCPI compatibility.

When the "OUTPut:IMPedance?" query is sent, the following is returned:

imp<NL>

Where:

- *imp* ::= The current output impedance if no argument is specified. In this version of the synthesizer, "+5.0000000000000E+001" will always be returned.
- *imp* ::= The maximum output impedance that can be obtained when the MAXimum argument is specified. In this version of the synthesizer, "+5.0000000000000E+001" will always be returned.
- *imp* ::= The minimum output impedance that can be obtained when the MINimum argument is specified. In this version of the synthesizer, "+5.0000000000000E+001" will always be returned.
- *imp* ::= The default (preset) output impedance if the DEFault argument is specified. In this version of the synthesizer, "+5.0000000000000E+001" will always be returned.

[SOURce[1]:]ROSCillator:SOURce?

[SOURce[1]:]ROSCillator:SOURce?

The "[SOURce[1]:]ROSCillator:SOURce?" query returns the source of the synthesizer timebase reference.

When the "[SOURce[1]:]ROSCillator:SOURce?" query is sent, the following is returned:

Sour<NL>

Where:

- *Sour* ::= "INT" if the synthesizer internal timebase reference is currently in use.
- *Sour* ::= "EXT" if an external timebase reference is currently in use.

NOTE

The synthesizer timebase is automatically switched to external if a signal greater than 0 dBm is applied to the 10 MHz IN BNC connector.

See Also

Connectors

SYSTem:ERRor?

`SYSTem:ERRor?`

The "SYSTem:ERRor?" query returns the oldest uncleared error number and error description from the synthesizer HP-IB error queue.

NOTE

The HP-IB error queue is separate from the front panel error queue (that is read by pressing the (MSG) key). Reading and clearing the HP-IB error queue has no effect on the front panel error queue.

When an error is read, it is cleared as long as the error condition no longer exists.

When the "SYSTem:ERRor?" query is sent, only the oldest unread error in the HP-IB error queue will be returned.

NOTE

The list of error messages in chapter 3 is organized in ascending error number order. Use the error number enclosed in parentheses when looking up the error condition in the table in chapter 3.

The HP-IB error queue can contain a maximum of 16 error messages. If the HP-IB error queue overflows, the 16th error in the queue will be replaced with `-350,"Queue overflow"`. If the queue is empty, the message `0,"No error"` will be returned.

NOTE

The HP-IB error queue returns the oldest error message when queried. Preset has no effect on the HP-IB error queue; it is only cleared at power up, by sending the "*CLS" command, or by reading its entire contents.

See Also

*CLS
Error Messages

SYSTem:VERSion?

`SYSTem:VERSion?`

The "SYSTem:VERSion?" query returns the SCPI (Standard Commands for Programmable Instruments) version number that the Synthesizer supports.

When the "SYSTem:VERSion?" query is sent, the following is returned:

vers<NL>

Where:

- *vers* ::= The SCPI version number currently supported by the Synthesizer.

*TST? (Self-Test Query)

```
*TST?
```

The "*TST?" query causes the instrument to perform a self-test.

No external equipment is required to run the instrument self-test. Prior to running the self-test, disconnect any equipment that is connected to the RF OUTPUT as the synthesizer might generate high output power during the self-test. When the self-test is complete, the synthesizer is set to the preset state.

The result of the instrument self-test will be placed in the output queue. A 0 indicates that the test passed and a non-zero value indicates that one or more of the self-test segments failed.

Instrument State Commands

Instrument State Commands

This sub-chapter contains detailed information on all programming commands pertaining to the state of the synthesizer.

*LRN? (Learn Device Setup Query)

```
*LRN?
```

The "*LRN?" query returns an HP-IB command that contains the current state of the synthesizer.

The information returned in response to the "*LRN?" query can be stored in a string variable in computer memory. When the string is issued to the synthesizer, the instrument settings are changed back to the state when the "*LRN?" query was executed.

The instrument settings captured by executing the "*LRN?" query include everything that is saved by executing the "*SAV" command. This includes user settings, including any active user special functions (and everything else affected by sending the "*RST" command).

NOTE

The instrument will not return the contents of the save/recall registers in response to executing the "*LRN?" query, nor the user flatness correction arrays.

The *LRN? response may have any ASCII character including "LF", so you must use the "USING" option of the "ENTER" BASIC command to cause the array variable to fill up until a <LF><EOI> sequence occurs.

See Also

*RCL
*RST
*SAV

MEMory:RAM:INITialize

MEMory:RAM:INITialize[**:ALL**]

The "MEMory:RAM:INITialize" command clears all of the synthesizer Random Access Memory (RAM).

When the "MEMory:RAM:INITialize" command is sent, all user settings are set to the preset state, save/recall registers are erased, and level correction data is cleared. Sending the "MEMory:RAM:INITialize" command does not clear factory calibration data stored in the instrument EEPROM. This command is useful when removing the synthesizer from a secure area as the setup history of the synthesizer will be erased.

See Also

ERASE MEMORY
*RST
SYSTem:PRESet

*RCL (Recall Command)

***RCL** *register*

The "*RCL" command allows you to recall a previously stored instrument state from one of ten register locations.

The parameter is as follows:

register	The number of the register where the desired instrument state has been stored. The number must be an integer from 0 to 9.

If you attempt to recall an instrument state from a register location to which an instrument state had not been previously saved, the preset state is recalled.

Instrument state registers are located in battery-backed RAM.

See Also

*SAV

*RST (Reset Command)

```
*RST
```

The "*RST" command sets the synthesizer to its initial state for programming.

The "*RST" (preset) conditions are shown in the following table:

PRESET Conditions

Parameter	Condition	Parameter	Condition
:CORRection:STATe	OFF	:POWer:ALC:PMETer:LEVel	0 dBm
:CORRection:CSET:SELect	FDAT1	:POWer:ATTenuation:AUTO	ON
:CORR:CSET:STATe	OFF	:POWer:LEVel	0 dBm[1]
:DISPlay:WINDow:STATe	ON	:POWer:PROTection:STATe	OFF
:FREQuency:CW	3 GHz	:SYSTem:COMMunicate:GPIB:ADDress	19[2]
:FREQuency:MULTiplier	1	:SYSTem:COMMunicate:PMETer:ADDress	13[2]
:MEMory:TABLe:SELect	FDAT1	:SYSTem:LANGuage	"SCPI"
:OUTPut:STATe	ON	:UNIT:FREQuency	HZ
:OUTPut:PROTection:STATe	ON	:UNIT:POWer	DBM
:POWer:ALC:SOURce	INT	:UNIT:TIMe	S

1 When option 1E1 is installed, the preset value for power level is −90 dBm for the HP 837311A/12A, and −110 dBm for the HP 83711B/12B.

2 Do not change with preset. These are default values when RAM memory is lost.

See Also

SYSTem:PRESet

*SAV (Save Command)

***SAV** *register*

The "*SAV" command allows you to save the instrument state in one of ten register locations.

The parameter is as follows:

register	The number of the register where the instrument state is to be stored. The number must be an integer from 0 to 9.

All user settings that are affected by preset will be saved. Level correction tables will not be saved.

Saving the instrument state to a given register location will write over any instrument state previously stored in that register.

Instrument state registers are located in battery-backed RAM.

See Also

*RCL

SYSTem:PRESet

`SYSTem:PRESet`

The "SYSTem:PRESet" command sets the synthesizer to the preset state.

The "SYSTem:PRESet" (preset) conditions are shown in the following table:

PRESET Conditions

Parameter	Condition
CORRection:CSET:SELect	FDAT1
CORRection:CSET:STATe	OFF
CORRection:STATe	OFF
DISPlay:WINDow:STATe	ON
FREQuency:CW	3 GHz
FREQuency:MULTiplier	1
MEMory:TABLe:SELect	FDAT1
OUTPut:STATe	ON
OUTPut:PROTection:STATe	ON
POWer:ALC:SOURce	INT

Parameter	Condition
POWer:ALC:PMETer:LEVel	0 dBm
POWer:ATTenuation:AUTO	ON
POWer:LEVel	0 dBm[1]
POWer:PROTection:STATe	OFF
SYSTem:COMMunicate:GPIB:ADDRess	19[2]
SYSTem:COMMunicate:PMETer:ADDRess	13[2]
SYSTem:LANGuage	"SCPI"
UNIT:FREQuency	HZ
UNIT:POWer	DBM
UNIT:TIME	S

1 When option 1E1 is installed, the preset value for power level is −90 dBm for HP 83711A/12A and −110 dBm for HP 83711B/12B.

2 Do not change with preset. These are default values when RAM memory is lost.

See Also

*RST

MEMory:CATalog[:ALL]?

MEMory:CATalog[:ALL]?

The "MEMory:CATalog[:ALL]?" query lists all level correction tables.

This command always returns the following:

1604,0, "FDAT1,TABLe,401", "FDAT2,TABLe,401", "FDAT3,TABLe,401", "FDAT4,TABLe,401".

See Also

MEMory:CATalog:TABLe?

MEMory:CATalog:TABLe?

MEMory:CATalog:TABLe?

The "MEMory:CATalog:TABLe?" query lists all level correction tables.

This command always returns the following:

1604,0, "FDAT1,TABLe,401", "FDAT2,TABLe,401", "FDAT3,TABLe,401", "FDAT4,TABLe,401".

See Also

MEMory:CATalog[:ALL]?

Level Correction Commands

Level Correction Commands

This sub-chapter contains detailed information on all programming commands pertaining to level correction.

MEMory:TABLe:FREQuency

MEMory:TABLe:FREQuency { *freq,freq,freq,...freq* | **MAXimum** | **MINimum** }

The "MEMory:TABLe:FREQuency" command is used to load the frequency points into the level correct table selected using the "MEMory:TABLe:SELect" command.

The parameter is as follows:

freq The frequency points that make up the frequency portion of a level correct table. Each "freq" parameter can be a numeric value or one of two optional parameters. These are explained further below:

- If the "freq" parameter is a numeric value, the parameter range is 1 GHz to 20 GHz for the HP 83711A/11B and 0.01 GHz to 20 GHz for the HP 83712A/12B.
- If the "freq" parameter is replaced with **MAXimum**, that frequency element of the level correct table will be set to its maximum allowable value.
- If the "freq" parameter is replaced with **MINimum**, that frequency element of the level correct table will be set to its minimum allowable value.

The string of frequency points must be separated by commas and can be from 2 to 401 frequency points long. If the string of frequency points is not in ascending order, an error message is generated and the string of frequency points is rejected (the previous frequency points in the table are unaffected).

If a frequency point entry is made that is not within its allowable range, an error message will be generated and the parameter will be set to either its upper or lower limit. The resolution for all frequency points is 1 kHz. All tables are preset at the factory with no frequency points loaded. Once loaded with frequency points, pressing the (PRESET) key has no effect on frequency points loaded into the tables.

NOTE

The total number of frequency points loaded using this command must be identical to the number of correction factors loaded with the "MEMory:TABLe:LOSS[:MAGNitude]" command. If they aren't identical, an error message will be generated when you try to use the table to correct power at the **RF OUTPUT** connector.

Query Syntax

```
MEMory:TABLe:FREQuency? [MAXimum]
                        [MINimum]
```

Returned format:

fdata<NL>

Where:

- *fdata* ::= The string of frequency points (separated by commas) that are currently loaded in the table selected with the "MEMory:TABLe:SELect" command if no argument is used.
- *fdata* ::= The maximum allowable frequency value for any frequency point if the MAXimum argument is specified.
- *fdata* ::= The minimum allowable frequency value for any frequency point if the MINimum argument is specified.

See Also

MEMory:TABLe:FREQuency:POINts?
MEMory:TABLe:LOSS[:MAGNitude]
MEMory:TABLe:LOSS[:MAGNitude]:POINts?
MEMory:TABLe:SELect
To Use the Level Correct Routine

MEMory:TABLe:FREQuency:POINts?

`MEMory:TABLe:FREQuency:POINts?` [`MAXimum` | `MINimum`]

The "MEMory:TABLe:FREQuency:POINts?" query returns the number of frequency points loaded into the level correct table currently selected using the "MEMory:TABLe:SELect" command.

When the "MEMory:TABLe:FREQuency:POINts?" query is sent, the following is returned:

poin<NL>

Where:

- *poin* ::= The number of frequency points currently loaded into the selected level correct table if no argument is specified.
- *poin* ::= The maximum number of frequency points that can be loaded into a table when the MAXimum argument is specified.
- *poin* ::= The minimum number of frequency points that can be loaded into a table when the MINimum argument is specified.

See Also

MEMory:TABLe:FREQuency
MEMory:TABLe:SELect
To Use the Level Correct Routine

MEMory:TABLe:LOSS[:MAGNitude]

MEMory:TABLe:LOSS[:MAGNitude] { *cf,cf,cf,...cf* | **MAXimum** | **MINimum** }

The "MEMory:TABLe:LOSS[:MAGNitude]" command is used to load the correction factors into the level correct table selected using the "MEMory:TABLe:SELect" command.

The parameter is as follows:

cf — The correction factors that make up the correction factor portion of a level correct table. Each "cf" parameter can be a numeric value or one of two optional parameters. These are explained further below:

- If the "cf" parameter is a numeric value, the parameter range is −40 dB to +40 dB.
- If the "cf" parameter is replaced with **MAXimum**, that correction factor element of the level correct table will be set to its maximum allowable value.
- If the "cf" parameter is replaced with **MINimum**, that correction factor element of the level correct table will be set to its minimum allowable value.

The string of correction factors must be separated by commas and can be from 2 to 401 correction factors long.

If a correction factor entry is made that is not within its allowable range, an error message will be generated and the parameter will be set to either its upper or lower limit. The resolution for all correction factors is 0.01 dB. All tables are preset at the factory with no correction factors loaded. Once loaded with correction factors, pressing the (PRESET) key has no effect on correction factors loaded into the tables.

NOTE

The total number of correction factors loaded using this command must be identical to the number of frequency points loaded with the "MEMory:TABLe:FREQuency" command. If they aren't identical, an error message will be generated when you try to use the table to correct power at the **RF OUTPUT** connector.

Query Syntax

```
MEMory:TABLe:LOSS[:MAGNitude]? [MAXimum]
                               [MINimum]
```

Returned format:

cfdata<NL>

Where:

- *cfdata* ::= The string of correction factors (separated by commas) that are currently loaded in the table selected with the "MEMory:TABLe:SELect" command if no argument is used.
- *cfdata* ::= The maximum allowable decibel value for any correction factor if the MAXimum argument is specified.
- *cfdata* ::= The minimum allowable decibel value for any correction factor if the MINimum argument is specified.

See Also

MEMory:TABLe:FREQuency
MEMory:TABLe:FREQuency:POINts?
MEMory:TABLe:LOSS[:MAGNitude]:POINts?
MEMory:TABLe:SELect
To Use the Level Correct Routine

MEMory:TABLe:LOSS[:MAGNitude]:POINts?

`MEMory:TABLe:LOSS[:MAGNitude]:POINts?` `[MAXimum | MINimum]`

The "MEMory:TABLe:LOSS[:MAGNitude]:POINts?" query returns the number of correction factors loaded into the level correct table currently selected using the "MEMory:TABLe:SELect" command.

When the "MEMory:TABLe:LOSS[:MAGNitude]:POINts?" query is sent, the following is returned:

poin<NL>

Where:

- *poin* ::= The number of correction factors currently loaded into the selected level correct table if no argument is specified.
- *poin* ::= The maximum number of correction factors that can be loaded into a table when the MAXimum argument is specified.
- *poin* ::= The minimum number of correction factors that can be loaded into a table when the MINimum argument is specified.

See Also

MEMory:TABLe:LOSS[:MAGNitude]
MEMory:TABLe:SELect
To Use the Level Correct Routine

MEMory:TABLe:SELect

`MEMory:TABLe:SELect FDAT`*tableno*

The "MEMory:TABLe:SELect" command selects the level correct table where level correct data will be loaded.

The parameter is as follows:

tableno	The number of the level correct table where level correct data will be loaded. The number must be an integer from 1 to 4.

This command selects one of four level correct tables where level correct data will be loaded using the "MEMory:TABLe:FREQuency" and "MEMory:TABLe:LOSS[:MAGNitude]" commands.

If a table number entry is made that is not within the allowable range, the level correct table entry is rejected and no action is taken by the synthesizer. The table is preset at the factory to 1.

Pressing the (PRESET) key has no effect on this command.

NOTE

The "MEMory:TABLe:SELect" command is used to select a table for data loading only. The "[SOURce[1]:]CORRection:CSET[:SELect]" command is used to select the level correct table that is used to correct power at the synthesizer **RF OUTPUT** connector.

Query Syntax

```
MEMory:TABLe:SELect?
```

Returned format:

FDAT*tableno*<NL>

Where:

- *tableno* ::= The level correct table currently selected to be loaded with level correct data.

See Also

MEMory:TABLe:FREQuency
MEMory:TABLe:LOSS[:MAGNitude]
[SOURce[1]:]CORRection:CSET[:SELect]
To Use the Level Correct Routine

[SOURce[1]:]CORRection:CSET[:SELect]

[SOURce[1]:]CORRection:CSET[:SELect]FDAT*tableno*

The "[SOURce[1]:]CORRection:CSET[:SELect]" command selects the level correct table that is used to correct power at the synthesizer RF OUTPUT connector.

The parameter is as follows:

tableno	The number of the level correct table that is used to correct power at the synthesizer RF OUTPUT connector. The number must be an integer from 1 to 4.

This command selects one of four level correct tables that are used to correct power at the synthesizer RF OUTPUT connector.

If a table number entry is made that is not within the allowable range, the level correct table entry is rejected and no action is taken by the synthesizer. Pressing the (PRESET) key selects level correct table number 1.

Notes

1. The "[SOURce[1]:]CORRection:CSET[:SELect]" command is used to select the level correct table that is used to correct power at the synthesizer **RF OUTPUT** connector. The "MEMory:TABLe:SELect" command is used to select a table for data loading.
2. If you attempt to use a level correct table that has an error, an error message is generated and no correction is applied to the synthesizer **RF OUTPUT** connector.

Query Syntax

```
[SOURce[1]:]CORRection:CSET[:SELect]?
```

Returned format:

FDAT*tableno*<NL>

Where:

- *tableno* ::= The level correct table currently selected to correct power at the synthesizer RF OUTPUT connector.

See Also

MEMory:TABLe:SELect
[SOURce[1]:]CORRection:CSET:STATe
[SOURce[1]:]CORRection[:STATe]
To Use the Level Correct Routine

[SOURce[1]:]CORRection:FLATness[:DATA]

```
[SOURce[1]:]CORRection :FLATness[:DATA]
{ freq,level,...freq,level }
{ MAXimum                  }
{ MINimum                  }
{ DEFault                  }
```

The "[SOURce[1]:]CORRection:FLATness[:DATA]" command sets the user frequency and level correction values. These values must be sent in frequency, level correction pairs. The input frequency range is dependent upon installed options; the level correction range is −40 dB to +40 dB.

For example:

```
CORRection:FLATness 1e9,0.1,2e9,0.2,3e9,0.3
```

The synthesizer will sort the entered list by frequency automatically. An instrument preset has no effect on the user level correction data. Note that this mnemonic cannot be used in a macro.

The parameters are as follows:

freq,level	Sets the user frequency and level correction values.
MAXimum	Sets the user frequency and level correction to the maximum allowable values.
MINimum	Sets the user frequency and level correction to the minimum allowable values.
DEFault	Sets the user frequency and level correction to the default (preset) values.

Query Syntax

```
[SOURce[1]:]CORRection:FLATness[:DATA]? [MAXimum|MINimum|DEFault]
```

Returned format:

freq,level<NL>

Where:

- *freq,level* ::= The current frequency and level correction values if no argument is specified.
- *freq,level* ::= The maximum frequency and level correction values that can be set if the MAXimum argument is specified.
- *freq,level* ::= The minimum frequency and level correction values that can be set if the MINimum argument is specified.
- *freq,level* ::= The default (preset) frequency and level correction values if the DEFault argument is specified.

See Also

[SOURce[1]:]CORRection:FLATness:POINts

[SOURce[1]:]CORRection:FLATness:POINts

[SOURce[1]:]CORRection:FLATness:POINts { *points* | MAXimum | MINimum | DEFault }

The "[SOURce[1]:]CORRection:FLATness:POINts" command sets the number of user frequency and level correction points (or pairs).

The parameters are as follows:

points	Sets the number of user frequency and level correction points.
MAXimum	Sets the number of user frequency and level correction points to the maximum number.
MINimum	Sets the number of user frequency and level correction points to the minimum number.
DEFault	Sets the number of user frequency and level correction points to the default (preset) number.

Query Syntax

[SOURce[1]:]CORRection:FLATness:POINts? [MAXimum | MINimum | DEFault]

Returned format:

points<NL>

Where:

- *points* ::= The current number of frequency and level correction pairs if no argument is specified.

- *points* ::= The maximum number of frequency and level correction pairs that can be set if the MAXimum argument is specified.
- *points* ::= The minimum number of frequency and level correction pairs that can be set if the MINimum argument is specified.
- *points* ::= The default (preset) number of frequency and level correction pairs if the DEFault argument is specified.

See Also

[SOURce[1]:]CORRection:FLATness[:DATA]

[SOURce[1]:]CORRection:CSET:STATe

[SOURce[1]:]CORRection:CSET:STATe { ON | OFF }

The "[SOURce[1]:]CORRection:CSET:STATe" command turns level correction on or off.

The parameters are as follows:

ON	Turns level correction on.
OFF	Turns level correction off.

Level correction must be turned on using this command and all corrections must be turned on using the "[SOURce[1]:]CORRection[:STATe]" command in order to turn the level correct function on. The preset condition for this command is off.

NOTE

If you attempt to use a level correct table that has an error, an error message is generated and no correction is applied to the synthesizer **RF OUTPUT** connector.

Query Syntax

[SOURce[1]:]CORRection:CSET:STATe?

Returned format:

state<NL>

Where:

- *state* ::= "+1" if level correction is currently turned on.
- *state* ::= "+0" if level correction is currently turned off.

See Also

[SOURce[1]:]CORRection:CSET[:SELect]
[SOURce[1]:]CORRection[:STATe]
To Use the Level Correct Routine

[SOURce[1]:]CORRection[:STATe]

[SOURce[1]:]CORRection[:STATe] { ON | OFF }

The "[SOURce[1]:]CORRection[:STATe]" command turns all corrections on or off.

NOTE

This command is provided for SCPI compatibility only. In this version of the synthesizer, the only correction available is level correction.

The parameters are as follows:

ON	Turns all corrections on.
OFF	Turns all corrections off.

All corrections must be turned on using this command and level corrections must be turned on using the "[SOURce[1]:]CORRection:CSET:STATe" command in order to turn the level correct function on. The preset condition for this command is off.

NOTE

If you attempt to use a level correct table that has an error, an error message is generated and no correction is applied to the synthesizer **RF OUTPUT** connector.

Query Syntax

`[SOURce[1]:]CORRection[:STATe]?`

Returned format:

state<NL>

Where:

- *state* ::= "+1" if all corrections are currently turned on.
- *state* ::= "+0" if all corrections are currently turned off.

See Also

[SOURce[1]:]CORRection:CSET[:SELect]
[SOURce[1]:]CORRection:CSET:STATe
To Use the Level Correct Routine

SYSTem:COMMunicate:PMETer:ADDRess

`SYSTem:COMMunicate:PMETer:ADDRess` { *address* | `MAXimum` | `MINimum` }

The "SYSTem:COMMunicate:PMETer:ADDRess" command allows you to change the HP-IB address that the synthesizer uses when communicating with an external power meter during the level correct routine.

The parameters are as follows:

address	The HP-IB address of the external power meter. The valid address range is 00 to 30 (decimal).
MAXimum	Sets the power meter HP-IB address to its maximum allowable value.
MINimum	Sets the power meter HP-IB address to its minimum allowable value.

NOTE

The "SYSTem:COMMunicate:PMETer:ADDRess" command sets the address that the synthesizer will use when communicating with the external power meter or when receiving data from the external power meter during the level correct routine. *This command does not set the address at the power meter.*

The external power meter HP-IB address set at the factory is 13. Pressing the (PRESET) key or sending the `*RST` or `SYSTem:PRESet` commands will not modify the address.

Query Syntax

```
SYSTem:COMMunicate:PMETer:ADDRess? [MAXimum | MINimum]
```

Returned format:

address<NL>

Where:

- *address* ::= The current external power meter HP-IB address when no optional argument is specified.
- *address* ::= The maximum allowable power meter HP-IB address when the MAXimum argument is specified.
- *address* ::= The minimum allowable power meter HP-IB address when the MINimum argument is specified.

See Also

To Use the Level Correct Routine

Macro Commands

Macro Commands

This sub-chapter contains detailed information on all programming commands pertaining to macros.

*DMC (Define Macro Command)

DMC "name***","***commands***"**

The "*DMC" command allows you to create a macro that consists of any combination of synthesizer programming commands.

The parameters are as follows:

name	The name for the macro. The name can consist of uppercase or lowercase alpha characters, numeric characters 0 through 9, or the underscore (_). The name must begin with an alpha character and can be up to 255 characters long.
commands	The synthesizer programming commands to be defined by the macro name. This must be IEEE String Program Data or Block Program Data format and can be up to 255 characters long.

Before macros that have been created by the *DMC command can be used, they must be enabled using the *EMC command.

See Also

*EMC
*GMC?
*LMC?
*PMC
*RMC

*EMC (Enable Macros)

*EMC { 0 / 1 }

The "*EMC" command enables or disables macros created with the "*DMC" command.

The parameters are as follows:

0	Disables macros created with the "*DMC" command.
1	Enables macros created with the "*DMC" command.

The preset condition for the "*EMC" command is "0" (disabled).

Query Syntax

*EMC?

Returned format:

state<NL>

Where:

- *state* ::= "+0" if macros are disabled or "+1" if macros are enabled.

See Also

*DMC
*GMC?
*LMC?
*PMC
*RMC

*GMC? (Get Macro Contents Query)

GMC? "name***"**

The "*GMC" query returns the commands that are in a given macro defined by the "*DMC" command.

The parameter is as follows:

name	The name of the macro for which you want to get the list of commands. This macro must have been previously defined with the "*DMC" command.

The synthesizer returns the list of macro commands in IEEE 488.2 Definite Length Arbitrary Block Response Data format.

See Also

*DMC
*EMC
*LMC?
*PMC
*RMC

*LMC? (List Macro Query)

```
*LMC?
```

The "*LMC?" query returns a listing of the names of all macros that have been defined by the "*DMC" command.

In response to the "*LMC?" query, the synthesizer will return a list of macro names defined. The macro names will be returned as string data separated by commas.

If no macros have been defined, the synthesizer will return the empty string ("") in response to the "*LMC?" query.

See Also

*DMC
*EMC
*GMC?
*PMC
*RMC

MEMory:FREE:MACRo?

```
MEMory:FREE:MACRo?
```

The "MEMory:FREE:MACRo?" query returns two numbers. The first is the number of bytes available for use in defining new macros. The second is the number of bytes currently being used for existing macros.

See Also

*DMC
*EMC
*GMC?
*PMC
*RMC

*PMC (Purge Macros Command)

```
*PMC
```

The "*PMC" command purges all macros that have been defined.

The "*PMC" command purges all defined macros. Purged macros are erased from memory and can not be recovered. To selectively purge certain macros, use the "*RMC" command.

See Also

*DMC
*EMC
*GMC?
*LMC?
*RMC

*RMC (Remove Macro Command)

***RMC "*name*"**

The "*RMC" command selectively purges a macro from the synthesizer memory.

The parameter is as follows:

name	The name of the macro that you want to purge. This macro must have been previously defined with the "*DMC" command.

The "*RMC" command purges only the macro whose name is stated with the command. The purged macro is erased from memory and can not be recovered. Only one macro can be purged per "*RMC" command. To purge all defined macros with one command, use the "*PMC" command.

If the "*RMC" command is sent and the macro to be purged does not exist, an error message will be generated.

See Also

*DMC
*EMC
*GMC?
*LMC?
*PMC

Miscellaneous Commands

Miscellaneous Commands

This sub-chapter contains detailed information on all miscellaneous programming commands.

DISPlay[:WINDow][:STATe]

DISPlay[:WINDow][:STATe] { ON | OFF }

The "DISPlay[:WINDow][:STATe]" command turns the fluorescent display and LED annunciators on and off.

The parameters are as follows:

ON	Turns the fluorescent display and LED annunciators on.
OFF	Turns the fluorescent display and LED annunciators off.

The display state is stored in the instrument state registers along with other instrument state data, so if sensitive instrument settings are stored to a register, the settings are not revealed when the register is recalled. The preset condition for the "DISPlay[:WINDow][:STATe]" command is ON.

NOTE

Once the display has been turned off, cycling the LINE switch off and then on will not restore the display.

Query Syntax

```
DISPlay[:WINDow][:STATe]?
```

Returned format:

state<NL>

Where:

- *state* ::= "+1" if the fluorescent display and LED annunciators are currently turned on.
- *state* ::= "+0" if the fluorescent display and LED annunciators are currently turned off.

SYSTem:KEY

SYSTem:KEY { *keycode* | MAXimum | MINimum }

The "SYSTem:KEY" command simulates pressing a front panel key.

The parameters are as follows:

keycode	The key code of the key to be pressed. The valid key code range is 0 to 62.
MAXimum	Sets the keycode to its maximum allowable value.
MINimum	Sets the keycode to its minimum allowable value.

Note that the key code represents the front panel key to be pressed. There is no unique key code for shifted functions and special functions. Note also that key codes can not simply be strung together in a command. If more than one key code is to appear on the same command line, the subsequent key codes must be preceded by ";KEY".

The valid key codes are shown in the following table:

Synthesizer Key Codes

Key Name	Key Code	Key Name	Key Code
SHIFT	0	5	40
PRESET	1	6	41
INT LEVEL	2	SPCL ON	42
MSG	4	MHz	42
RECALL	5	⇒	45
EXT DIODE	6	STEP SIZE	46
LOCAL	8	1	47
SPCL	9	2	48
EXT METER	10	3	49
⇑	12	kHz	50
7	13	SPCL OFF	50
8	14	RF ON/OFF	53
FREQ	23	BACK SPACE	54
POWER LEVEL	32	0	55
9	33	.	56
dB	34	−	57
dBm	34	Hz	58
GHz	34	ENTER	58
⇐	37	Clockwise Knob Rotation	61[1]
⇓	38	Counterclockwise Knob Rotation	62[2]
4	39		

1 Sending this key code simulates rotating the knob clockwise one step by its finest resolution.

2 Sending this key code simulates rotating the knob counterclockwise one step by its finest resolution.

If a key code is sent that is between 0 and 62, but does not appear in the table, it will be ignored.

Query Syntax

```
SYSTem:KEY? [MAXimum]
            [MINimum]
```

Returned format:

keycode<NL>

Where:

- *keycode* ::= The last key pressed if no optional argument is specified. If −1 is returned, no key has been pressed since the synthesizer has been powered up or preset.

NOTE

This is a two key queue. It saves the first two keys pressed. Subsequent keystrokes are not saved unless the queue is cleared or reported. PRESET or power up clears the key queue.

- *keycode* ::= The maximum allowable key code when the MAXimum argument is specified.
- *keycode* ::= The minimum allowable key code when the MINimum argument is specified.

Power Level Commands

Power Level Commands

This sub-chapter contains detailed information on all programming commands pertaining to power level control.

[SOURce[1]:]POWer[:LEVel]

```
[SOURce[1]:]POWer[:LEVel][:IMMediate][:AMPLitude]
{ ampl   }
{ MAXimum }
{ MINimum }
{ UP      }
{ DOWN    }
{ DEFault }
```

The "[SOURce[1]:]POWer[:LEVel]" command sets the output power level of the synthesizer.

The parameters are as follows:

ampl	Sets the synthesizer output power level. The allowable range for the parameter is −120 dBm (−100 dBm on HP 83711A/12A) to +30 dBm if Option 1E1 is installed and −15 dBm to +30 dBm if Option 1E1 is not installed.
MAXimum	Sets the synthesizer output power level to the maximum allowable value.
MINimum	Sets the synthesizer output power level to the minimum allowable value.
UP	Increases the synthesizer output power level by the current power level increment value.
DOWN	Decreases the synthesizer output power level by the current power level increment value.
DEFault	Sets the synthesizer output power level to its default (preset) value.

The allowable range for the *ampl* parameter is −120 dBm (−100 dBm on HP 83711/A/12A) to +30 dBm if Option 1E1 is installed and −15 dBm to +30 dBm if Option 1E1 is not installed.

NOTE

The actual maximum internally leveled output power for your instrument at a given frequency can be found by increasing the synthesizer output power until the **UNLVL** annunciator lights.

If a power level entry is made that is not within the allowable parameter range, an error message will be generated and the parameter will be set to either its maximum or minimum limit. Power level resolution is 0.01 dB. The preset value is −110 dBm (−90 dBm on HP 83711A/12A) if Option 1E1 is installed and 0 dBm if Option 1E1 is not installed.

When the power level is modified, the synthesizer circuitry will ensure that transitions from one power level to another will not allow the level to exceed the maximum of the two levels.

Four options are available for leveling of the output power. These are internal leveling, external diode leveling, external power meter leveling, and the level correct routine. Refer to the "[SOURce[1]:]POWer:ALC" command and level correct-related commands for information on the different leveling options.

Query Syntax

```
[SOURce[1]:]POWer[:LEVel][:IMMediate][:AMPLitude]?
[MAXimum]
[MINimum]
[DEFault]
```

Returned format:

ampl<NL>

Where:

- *ampl* ::= The current output power level if no argument is specified.
- *ampl* ::= The maximum output power level that can be set if the MAXimum argument is specified.
- *ampl* ::= The minimum output power level that can be set if the MINimum argument is specified.
- *ampl* ::= The default (preset) output power level if the DEFault argument is specified.

See Also

[SOURce[1]:]POWer:ALC:SOURce
[SOURce[1]:]POWer[:LEVel]:STEP
UNIT:POWer|:VOLTage

[SOURce[1]:]POWer[:LEVel]:STEP

[SOURce[1]:]POWer[:LEVel][:IMMediate][:AMPLitude]
:STEP[:INCRement] { *incr* | MAXimum | MINimum | DEFault }

The "[SOURce[1]:]POWer[:LEVel]:STEP" command selects the increment value for the synthesizer output power level.

The parameters are as follows:

incr	Sets the increment value for output power level. The allowable range for the parameter is 0.01 dB to 150 dB if Option 1E1 is installed and 0.01 dB to 45 dB if Option 1E1 is not installed.
MAXimum	Sets the power level increment value to its maximum allowable value.
MINimum	Sets the power level increment value to its minimum allowable value.
DEFault	Sets the power level increment value to its default (preset) value.

When the "UP" or "DOWN" parameters are used with the "[SOURce[1]:]POWer[:LEVel]" command, the output power level will be increased or decreased by a step size set with the "[SOURce[1]:]POWer[:LEVel]:STEP" command.

Numeric power level increment value entries have a resolution 0.01 dB.

If a power level increment value entry is made that is not within the allowable parameter range, an error message will be generated and the parameter will be set to either its maximum or minimum limit. The preset value for the power level increment value is 1 dB.

Query Syntax

```
[SOURce[1]:]POWer[:LEVel][:IMMediate][:AMPLitude]
:STEP[:INCRement]? [MAXimum|MINimum|DEFault]
```

Returned format:

incr<NL>

Where:

- *incr* ::= The current power level increment value if no argument is specified.
- *incr* ::= The maximum power level increment value that can be set if the MAXimum argument is specified.
- *incr* ::= The minimum power level increment value that can be set if the MINimum argument is specified.
- *incr* ::= The default (preset) power level increment value if the DEFault argument is specified.

See Also

[SOURce[1]:]POWer[:LEVel]
UNIT:POWer|:VOLTage

[SOURce[1]:]POWer[:LEVel]:STEP

Programmable Interface Commands

Programmable Interface Commands

This sub-chapter contains detailed information on all programming commands pertaining to the programmable interface.

*OPC (Operation Complete)

```
*OPC
```

The "*OPC" command sets bit 0 in the Standard Event Status register to one (1) when the synthesizer has completed execution of all programming commands preceding it.

Query Syntax

The "*OPC" command or the "*OPC?" query should appear as the last command in a command line.

```
*OPC?
```

Returned format:

number<NL>

Where:

- *number* ::= "+1" when bit 0 in the Standard Event Status register has been set to one.

See Also

*ESE
*ESR?
*SRE
*STB?
*WAI

SYSTem:COMMunicate:GPIB:ADDRess

`SYSTem:COMMunicate:GPIB:ADDRess` { *address* | `MAXimum` | `MINimum` }

The "SYSTem:COMMunicate:GPIB:ADDRess" command allows you to change the synthesizer HP-IB address.

The parameters are as follows:

address	The HP-IB address of the synthesizer. The valid address range is 00 to 30 (decimal).
MAXimum	Sets the synthesizer HP-IB address to its maximum allowable value.
MINimum	Sets the synthesizer HP-IB address to its minimum allowable value.

The HP-IB address set at the factory is 19. Pressing the (PRESET) key or sending the **`*RST`** or **`SYSTem:PRESet`** commands will not change the HP-IB address. When the HP-IB address is changed, the new address takes affect immediately.

Query Syntax

```
SYSTem:COMMunicate:GPIB:ADDRess? [MAXimum]
                                 [MINimum]
```

Returned format:

address<NL>

Where:

- *address* ::= The current HP-IB address of the synthesizer when no optional argument is specified.
- *address* ::= The maximum allowable Synthesizer HP-IB address when the MAXimum argument is specified.
- *address* ::= The minimum allowable synthesizer HP-IB address when the MINimum argument is specified.

SYSTem:LANGuage

```
SYSTem:LANGuage { "SCPI"
                  "COMP=8673"
                  "COMPATIBILITY=8673" }
```

The "SYSTem:LANGuage" command sets the programming language that is accepted by the synthesizer.

The parameters are as follows:

"SCPI"	Sets the programming language to "SCPI" (Standard Commands for Programmable Instruments). This is the current industry standard and is the language documented in this manual.
"COMP=8673"	Sets the programming language to HP 8673 emulation. See HP 8673 Compatibility Guide section of this manual.

The programming language set at the factory is SCPI. Pressing the PRESET key or sending the `*RST` or `SYSTem:PRESet` commands will not change the programming language.

NOTE

Double quotation marks are required as part of the argument.

Query Syntax

```
SYSTem:LANGuage?
```

Returned format:

lang<NL>

Where:

- *lang* ::= "SCPI" if SCPI programming language is currently chosen.
- *lang* ::= "CIIL" if the CIIL programming language special order option is installed and the CIIL programming language is currently chosen.

UNIT:FREQuency

`UNIT:FREQuency` {*freq suffix*}

The "UNIT:FREQuency" command determines the default suffix that will be assumed for the numeric argument of all frequency-related programming commands if no suffix is used. It also determines the units for the data that frequency-related queries return.

The parameter is as follows:

freq suffix — The default suffix to be assumed by all frequency-related programming commands when no suffix is used.

This command determines the default suffix that will be assumed for the numeric argument of all frequency-related programming commands when no suffix is used. The preset default suffix is hertz (HZ). For example, if you wanted to set the synthesizer output frequency to 2.5 GHz with the default suffix being hertz (the preset value), you could send the following command:

```
OUTPUT 719; "FREQ 2500000000"
```

If you were to change the default suffix to gigahertz by sending the command "UNIT:FREQ GHZ", the following command could be sent to set the synthesizer output frequency to 2.5 GHz:

```
OUTPUT 719; "FREQ 2.5"
```

The available default suffixes appear in the following table. You will not likely want to use all of these default suffixes, but they are available.

Available Default Suffixes

Default Suffix	Multiplication Factor
EXHZ	1×10^{18}
PEHZ	1×10^{15}
THZ	1×10^{12}
GHZ	1×10^{9}
MHZ	1×10^{6}
KHZ	1×10^{3}
HZ	1×10^{0}
UHZ	1×10^{-6}
NHZ	1×10^{-9}
PHZ	1×10^{-12}
FHZ	1×10^{-15}
AHZ	1×10^{-18}

NOTE

There is no suffix for "1×10^{-3}" when working with the HZ suffix.

Query Syntax

```
UNIT:FREQuency?
```

Returned format:

freq suffix<NL>

Where:

- *freq suffix* ::= The current default suffix for frequency-related programming commands and queries.

`UNIT:POWer|:VOLTage` { *level suffix* }

The "UNIT:POWer|:VOLTage" command determines the default suffix that will be assumed for the numeric argument of all power level-related programming commands if no suffix is used. It also determines the units for the data that power level-related queries return.

The parameter is as follows:

level suffix — The default suffix to be assumed by all power level-related programming commands when no suffix is used.

This command determines the default suffix that will be assumed for the numeric argument of all power level-related programming commands when no suffix is used. The preset default suffix is dBm (DBM). For example, if you wanted to set the synthesizer output power level to 13 dBm with the default suffix being dBm (the preset value), you could send the following command:

```
OUTPUT 719; "POW 13"
```

If you were to change the default suffix to milliwatts by sending the command "UNIT:POW MW", the following command could be sent to set the synthesizer output power level to 13 dBm.

```
OUTPUT 719; "POW 20"  20 mw is equal to 13 dBm.
```

There are several suffixes related to power level that can be used. These suffixes appear in the following table ("mult" can be left blank or replaced by the desired suffix multiplier, which is explained after the following table):

Power Level-Related Suffixes

Suffix	Description
"mult"V	Volts
"mult"W	Watts
DB"mult"V	Decibel Volts
DB"mult"W	Decibel Watts

The suffixes in the above table can include an optional suffix multiplier in place of "mult". For example, the volts suffix "V" can be preceded by the suffix multiplier "M" to yield MV (millivolts) or 1×10^{-3} volts.

The available suffix multipliers appear in the following table.

Available Suffix Multipliers

Suffix Multiplier	Multiplication Factor
EX	1×10^{18}
PE	1×10^{15}
T	1×10^{12}
G	1×10^{9}
MA	1×10^{6}
K	1×10^{3}
M[1]	1×10^{-3}
U	1×10^{-6}
N	1×10^{-9}
P	1×10^{-12}
F	1×10^{-15}
A	1×10^{-18}

1 The suffix "DBM" is equivalent to the suffix "DBMW."

Query Syntax

```
UNIT:POWer|:VOLTage?
```

Returned format:

level suffix<NL>

Where:

- *level suffix* ::= The current default suffix (including the suffix multiplier) for power level-related programming commands and queries.

*WAI (Wait-to-Continue Command)

```
*WAI
```

The "*WAI" command makes the synthesizer wait until pending operations have taken place, then continues executing commands that follow the "*WAI" command.

The "*WAI" command is useful when placed after those commands that are not necessarily finished executing before the next HP-IB command is executed when it is critical that they be finished executing. In general, SCPI commands execute sequentially but the "*WAI" command can be used to allow the hardware to settle after a command is executed.

See Also

*OPC

RF Output Control Commands

RF Output Control Commands

This sub-chapter contains detailed information on all programming commands pertaining to RF output control.

OUTPut:PROTection[:STATe]

`OUTPut:PROTection[:STATe]` { `ON` | `OFF` }

The "OUTPut:PROTection[:STATe]" command turns RF protection during frequency switching on or off. This function is useful when measuring the synthesizer frequency switching time.

The parameters are as follows:

ON	Turns RF protection on during frequency switching.
OFF	Turns RF protection off during frequency switching.

The synthesizer contains an RF protection circuit that momentarily attenuates output power and then brings the output power back up to the required level (in 20 ms nominal) when the synthesizer output frequency is changed. This circuit assures that the output power does not overshoot the power level set via the front panel or HP-IB during frequency switching.

When the synthesizer is set to the preset state, RF protection is turned on.

Notes

1. RF protection during frequency switching can not be turned off when AM, FM, or pulse modulation is being used. It can only be turned off when the synthesizer is in CW mode.
2. Even when the synthesizer is in CW mode, and the RF protection during frequency switching function is turned off, the RF protection circuit will switch in when the synthesizer divider circuits switch or whenever frequency switches greater than 260 MHz occur.

Query Syntax

```
OUTPut:PROTection[:STATe]?
```

Returned format:

state<NL>

Where:

- *state* ::= "+1" if RF protection during frequency switching is currently turned on.
- *state* ::= "+0" if RF protection during frequency switching is currently turned off.

See Also

[SOURce[1]:]FREQuency[:CW|:FIXed]

OUTPut[:STATe]

OUTPut[:STATe] { ON | OFF }

The "OUTPut[:STATe]" command turns the signal at the RF OUTPUT connector on and off.

The parameters are as follows:

ON	Turns the signal at the RF OUTPUT connector on.
OFF	Turns the signal at the RF OUTPUT connector off.

When the "OUTP:STAT OFF" command is sent to the synthesizer, the internal oscillators are turned off, and the internal RF power shutdown circuit is turned on. The preset state for the signal at the RF OUTPUT connector is on.

Query Syntax

OUTPut[:STATe]?

Returned format:

state<NL>

Where:

- *state* ::= "+1" if the signal at the RF OUTPUT connector is currently turned on.
- *state* ::= "+0" if the signal at the RF OUTPUT connector is currently turned off.

See Also

Connectors

[SOURce[1]:]POWer:ATTenuation:AUTO

[SOURce[1]:]POWer:ATTenuation:AUTO { ON | OFF | ONCE }

The "[SOURce[1]:]POWer:ATTenuation:AUTO" command turns the attenuator hold function on or off.

The parameters are as follows:

ON	Turns the attenuator hold function off.
OFF	Turns the attenuator hold function on.
ONCE	Turns the attenuator hold function off and then on.

The attenuator hold function can be used to extend the vernier range to prevent the step attenuator from switching between two levels. Locking the step attenuator keeps the attenuator from switching between the two levels as leveled power is varied above and below the threshold level, thus saving wear on the attenuator. Refer to the specification table for the "Attenuator Switch Point Threshold".

When the "ONCE" parameter is used, the attenuator hold function is temporarily turned off so that the synthesizer can automatically update the attenuator setting, then it is turned on to lock the attenuator at that setting.

Advantages

Locking the step attenuator prevents switching between two levels when the leveled output power is set near an attenuator switching threshold. This is useful when using external leveling.

Disadvantages

When the step attenuator is locked, the output power dynamic range is limited to the vernier range at the current output frequency. The vernier range extends from a lower limit that is typically 5 dB lower than the specified value for that range to an upper limit that is frequency dependent on the synthesizer output frequency.

NOTE

In external diode detector leveling or external power meter leveling mode, the attenuator is always locked in the current range and can not be unlocked using this function.

Query Syntax

```
[SOURce[1]:]POWer:ATTenuation:AUTO?
```

Returned format:

state<NL>

Where:

- *state* ::= "+1" if the attenuator hold function is currently off or "+0" if the attenuator hold function is currently on or set to "once".

See Also

[SOURce[1]:]POWer[:LEVel]

Status Register Commands

Status Register Commands

This sub-chapter contains detailed information on all programming commands pertaining to the status register.

The Status Register System

You can find out the state of certain instrument hardware and firmware events and conditions by programming the status register system. The status register system is arranged in a hierarchical order. Three lower status groups provide information to the status byte group. The status byte group is used to determine the general nature of an event and the lower status groups are used to determine the specific nature of the event. A **status group** is a set of related registers whose contents are programmed in order to produce status summary bits. The hierarchy of the status register system is shown in Figure 2k-1.

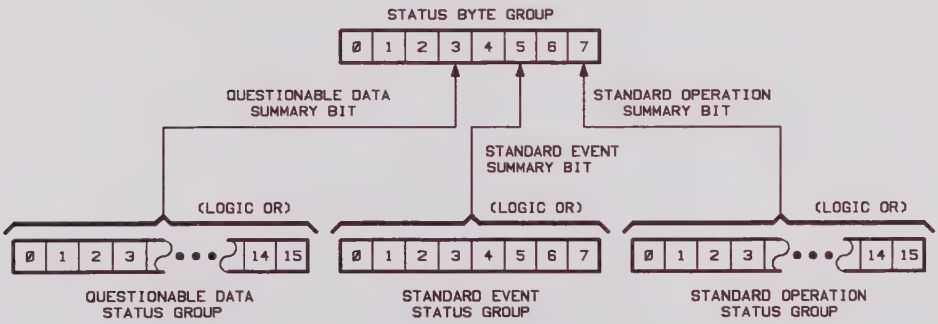

STATUS BYTE GROUP
0 1 2 3 4 5 6 7
QUESTIONABLE DATA SUMMARY BIT
STANDARD EVENT SUMMARY BIT
STANDARD OPERATION SUMMARY BIT
(LOGIC OR)
(LOGIC OR)
(LOGIC OR)
0 1 2 3 ••• 14 15
0 1 2 3 4 5 6 7
0 1 2 3 ••• 14 15
QUESTIONABLE DATA STATUS GROUP
STANDARD EVENT STATUS GROUP
STANDARD OPERATION STATUS GROUP

Figure 2k-1. Status Register System Hierarchy

General Status Group Model

Figure 2k-2 shows the structure of a typical status group. Corresponding bits in the Condition Register are filtered by the Negative and Positive Transition Registers and stored in the Event Register. The contents of the Event Register are logically ANDed with the contents of the Enable Register and the result is logically ORed to produce a status summary bit.

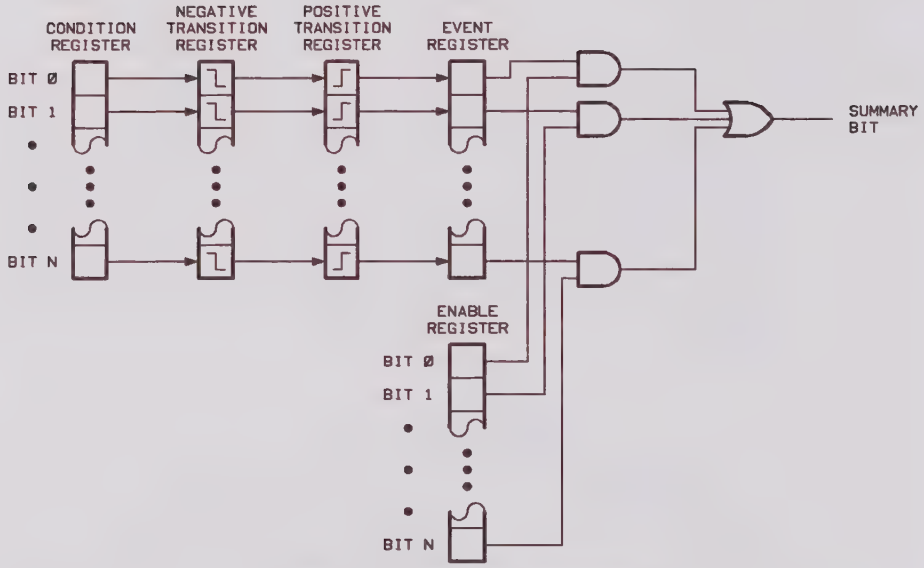


Figure 2k-2. General Status Group Model

Note that each status group does not necessarily contain all of the registers shown in Figure 2k-2. For example, the Standard Event status group only contains an Event Register and an Enable Register. Each of the synthesizer status groups consists of some or all of the registers explained below:

Condition Register

A condition register continuously monitors the hardware and firmware status of the synthesizer. There is no latching or buffering for a condition register; it is updated in real time.

Negative Transition Register

A negative transition register specifies the bits in the condition register that will set corresponding bits in the event register when the condition bit changes from 1 to 0.

Positive Transition Register

A positive transition register specifies the bits in the condition register that will set corresponding bits in the event register when the condition bit changes from 0 to 1.

Event Register

An event register latches transition events from the condition register as specified by the positive and negative transition registers. Bits in the event register are latched, and once set, they remain set until cleared by either querying the register contents or sending the "*CLS" command.

Enable Register

An enable register specifies the bits in the event register that can generate a summary bit. The synthesizer logically ANDs corresponding bits in the event and enable registers, and ORs all the resulting bits to produce a summary bit. Summary bits are, in turn, used by the Status Byte group.

Synthesizer Status Groups

The synthesizer status register system consists of the Status Byte group and three other status groups that provide input to the Status Byte group. The following paragraphs explain the information that is provided by each status group.

The Status Byte Group

The Status Byte group is used to determine the general nature of an instrument event or condition. The Status Byte group consists of the Service Request Enable register and the Status Byte. The bits in the Status Byte provide you with the following information:

Bit	Description
0 - 2	These bits are always set to 0.
3	A 1 in this bit position indicates that the Questionable Data summary bit has been set. The Questionable Event register can then be read to determine the specific condition that caused this bit to be set.
4	A 1 in this bit position indicates that the synthesizer has data ready in its output queue. Note that there are no lower status groups that provide input to this bit.
5	A 1 in this bit position indicates that the Standard Event summary bit has been set. The Standard Event Status register can then be read to determine the specific event that caused this bit to be set.

6	A 1 in this bit position indicates that the instrument has at least one reason to require service. The bits in the Status Byte are logically ANDed with the Service Request Enable register and the result is ORed and input to this bit.
7	A 1 in this bit position indicates that the Standard Operation summary bit has been set. The Operation Event register can then be read to determine the specific condition that caused this bit to be set.

The Standard Event Status Group

The Standard Event Status group is used to determine the specific event that set bit 5 in the Status Byte. The Standard Event Status group consists of the Standard Event Status register (an Event register) and the Standard Event Status Enable register. The bits in the Standard Event Status register provide you with the following information:

Bit	Description
0	A one in this bit position indicates that all pending synthesizer operations were completed following execution of the "*OPC" command.
1	This bit is always set to 0.
2	A one in this bit position indicates that a query error has occurred. Query errors have SCPI error numbers from −499 to −400.
3	A one in this bit position indicates that a device dependent error has occurred. Device dependent errors have SCPI error numbers from −399 to −300 and 1 to 32767.
4	A one in this bit position indicates that an execution error has occurred. Execution errors have SCPI error numbers from −299 to −200.
5	A one in this bit position indicates that a command error has occurred. Command errors have SCPI error numbers from −199 to −100.
6	A one in this bit position indicates that at least one front panel key (except the LINE switch) has been pressed (even if the synthesizer is in Local Lockout (LLO) mode).
7	A one in this bit position indicates that the synthesizer has been turned off and then on.

The Standard Operation Status Group

The Standard Operation status group is used to determine the specific condition that set bit 7 in the Status Byte. The Standard Operation status group consists of the Operation Condition register, Operation Negative Transition register, Operation Positive Transition register, Operation Event register, and Operation Event Enable register. The bits in the Operation Event register provide you with the following information:

Bit	Description
0	A one in this bit position indicates that the YIG oscillator calibration is currently being run.
1	A one in this bit position indicates that the synthesizer hardware is settling (for example, the power level is changing).
2 - 6	These bits are always set to 0.
7	A one in this bit position indicates that the synthesizer level correct routine is being run.
8 - 15	These bits are always set to 0.

The Questionable Data Status Group

The Questionable Data status group is used to determine the specific condition that set bit 3 in the Status Byte. The Questionable Data status group consists of the Questionable Condition register, Questionable Negative Transition register, Questionable Positive Transition register, Questionable Event register, and Questionable Event Enable register. The bits in the Questionable Event register provide you with the following information:

Bit	Description
0 - 2	These bits are always set to 0.
3	A one in this bit position indicates that the RF output power might be uncalibrated or unleveled.
4	A one in this bit position indicates that the internal frequency reference oven is cold (option 1E5 only).
5	A one in this bit position indicates that the synthesizer output frequency might be uncalibrated.
6	This bit is always set to 0.
7	A one in this bit position indicates that one or more of the modulations might be uncalibrated.

8 This bit is set to 1 whenever bits 3, 5, or 7 in this register are set to 1.

9 - 15 These bits are always set to 0.

Status Register System Programming Example

In the following example, the Status Register System is programmed to set bit 6 of the status byte (the SRQ bit) high after the synthesizer hardware has settled. Bit 6 is monitored and, once it is set high, the controller prints "HARDWARE IS SETTLED" on its screen.

```
10  OUTPUT 719;"STAT:OPER:PTR 0"
20  OUTPUT 719;"STAT:OPER:NTR 2"
30  OUTPUT 719;"STAT:OPER:ENAB 2" "
40  OUTPUT 719;"*SRE 128" "
50  PRINT "SRQ IS SET UP" "
60  OUTPUT 719;"*CLS" "
70  A=SPOLL(719)"
80  OUTPUT 719;"FREQ 2.123GHz;POW -1.23dBm" "
90  Wait4srq: A=SPOLL(719)"
100  IF A=0 THEN GOTO Wait4srq"
110  PRINT "HARDWARE IS SETTLED" '
120  END"
```

Program Comments

10: Disable all bits in the Operation Positive Transition register.

20: Enable bit 2 (the "hardware settling" bit) in the Operation Negative Transition register.

30: Enable bit 2 (the "hardware settling" bit) in the Operation Event Enable register.

40: Enable bit 7 (the OPERation summary bit) in the Service Request Enable register to cause an SRQ.

60: Clear any previous status conditions.

70: Clear old SRQ state.

```
80:     Set Synthesizer output frequency and power.
90:     Poll the SRQ state.
100:    If no SRQ has been generated, keep polling.
```

*CLS (Clear Status Command)

```
*CLS
```

The "*CLS" command clears the Operation Event register, Questionable Event register, and the Standard Status Event register.

Sending the "*CLS" command sets all bits in the Operation Event register, Questionable Event register, and the Standard Status Event register to 0. Clearing these registers causes bits 3, 5, and 7 in the Status Byte register to be temporarily set to 0. The "*CLS" command also clears the HP-IB error reporting queue and the Request-for-OPC flag.

If the *CLS command immediately follows a Program Message Terminator, the output queue and the MAV bit will also be cleared.

The *CLS command does not clear data memories or any instrument settings.

See Also

*ESR?
STATus:OPERation[:EVENt]?
STATus:QUEStionable[:EVENt]?
*STB?

*ESE (Standard Event Status Enable)

*ESE *number*

The "*ESE" command sets the Standard Event Status Enable register. This register selects which bits in the Standard Event Status Register can set bit 5 in the status byte.

The parameter is as follows:

number — The number representing the value of bits in the Standard Event Status Enable register to be set. *number* can be from 0 to 255.

Bits in the Standard Event Status Enable register are logically ANDed with bits in the Standard Event Status register. If the result is 1, bit 5 in the status byte is set.

The decimal value of each bit in the Standard Event Status Enable register is shown in the following table.

Standard Event Status Enable Register Bit Definitions

Bit	Weight	Enables
7	128	PON - Power on occurred.
6	64	URQ - User request (key pressed).
5	32	CME - Command error occurred.
4	16	EXE - Execution error occurred.
3	8	DDE - Device dependent error occurred.
2	4	QYE - Query error occurred.
1	2	RQC - Request control (not used).
0	1	OPC - Operation complete.

At power on, the Standard Event Status Enable register is set to 0 unless the *PSC command has been set to 0.

Query Syntax

```
*ESE?
```

Returned format:

number<NL>

Where:

- *number* ::= The current value of the Standard Event Status Enable register.

See Also

*CLS
*ESR?
*OPC
*PSC
*SRE
*STB?

*ESR? (Standard Event Status Register Query)

*ESR?

The "*ESR?" query returns the contents of the Standard Event Status register.

When you read the contents of the Event Status register, the value returned is the total bit weights of all the bits that are high at the time you read it.

The decimal value of each bit (the bit weight) in the Event Status register is shown in the following table.

Standard Event Status Register Bit Definitions

Bit	Weight	Name	Condition
7	128	PON	0 = no OFF to ON transition has occurred with the synthesizer power. 1 = an OFF to ON transition has occurred with the synthesizer power.
6	64	URQ	0 = no front panel key has been pressed. 1 = front panel key has been pressed.
5	32	CME	0 = no command errors have been detected. 1 = a command error has been detected.
4	16	EXE	0 = no execution error has been detected. 1 = an execution error has been detected.
3	8	DDE	0 = no device dependent errors have been detected. 1 = a device dependent error has been detected.
2	4	QYE	0 = no query errors have been detected. 1 = a query error has been detected.
1	2	RQC	Not used - always 0.
0	1	OPC	0 = operation is not complete. 1 = operation is complete.

The Event Status register is cleared (set to 0) when the "*CLS" command is sent or after "*ESR?" is executed.

Status Reporting

When an error is reported to the HP-IB error queue, one of the Standard Event Status Register error bits will also be set. Which bit is set depends on the value of the error number. If the error number is from −199 to −100, the Command Error bit is set. If the error number is from −299 to −200, the Execution Error bit is set. If the error number is from −399 to −300 or from 1 to 32767, the Device Dependent Error bit is set. If the error number is from −499 to −400, the Query Error bit is set.

See Also

*CLS
*ESE
*OPC
*SRE
*STB?

*PSC (Power-On Status Clear)

*PSC { 0 | 1 }

The "*PSC" command enables or disables the automatic power-on clearing of the Service Request Enable (*SRE) register and the Standard Event Status Enable (*ESE) register. It also enables or disables the automatic power-on presetting of the SCPI STATus transition registers and enable registers.

The parameters are as follows:

0	Disables clearing of Service Request Enable (*SRE) register and Standard Event Status Enable (*ESE) register at power up as well as power-on presetting of the SCPI STATus transition registers and enable registers.
1	Enables clearing of Service Request Enable (*SRE) register and Standard Event Status Enable (*ESE) register at power up as well as power-on presetting of the SCPI STATus transition registers and enable registers.

The factory preset condition for the "*PSC" command is "1" (clearing enabled). Once the *PSC value is changed, it is not affected by pressing the PRESET key or sending the "*RST" or "SYST:PRES" commands.

Query Syntax

```
*PSC?
```

Returned format:

state<NL>

Where:

- *state* ::= "+0" if clearing of the *SRE and *ESE registers at power-up is disabled or "+1" if clearing of the *SRE and *ESE registers at power-up is enabled.

See Also

*ESE
*SRE

*SRE (Service Request Enable)

*SRE *number*

The "*SRE" command sets the Service Request Enable register bits.

The parameter is as follows:

number — The number representing the value of bits in the Service Request Enable register to be set. The number can be from 0 to 191.

The Service Request Enable register contains a mask value for the bits to be enabled to produce an SRQ in the status byte. A 1 in the Service Request Enable register will enable the corresponding bit in the status byte. A 0 will disable the bit.

The decimal value of each bit in the Service Request Enable register is shown in the following table.

Service Request Enable Register Bit Definitions

Bit	Weight	Enables
7	128	SCPI operation summary bit.
6	64	Cannot be set.
5	32	ESB - Event Status Bit.
4	16	MAV - Message Available.
3	8	SCPI questionable summary bit.
2	4	Don't care.
1	2	Don't care.
0	1	Don't care.

At power on, the Service Request Enable register is set to 0 unless the *PSC command has been set to 0.

Query Syntax

```
*SRE?
```

Returned format:

number<NL>

Where:

- *number* ::= The current value of the Service Request Enable register.

See Also

*ESE
*ESR?
*PSC
*STB?

STATus:OPERation:CONDition?

```
STATus:OPERation:CONDition?
```

The "STATus:OPERation:CONDition?" query returns the contents of the Operation Condition register.

The Operation Condition register is constantly updated as operational conditions occur. No conditions are saved in this register.

When you read the contents of the Operation Condition register, the value returned is the total bit weights of all the bits that are high at the time you read it. When you read the contents of the Operation Condition register using this command, the contents of the register are not altered.

The decimal value of each bit (the bit weight) in the Operation Condition register is shown in the following table.

Operation Condition Register Bit Definitions

Bit	Weight	Condition
15	32768	Not used - always 0.
14	16384	Not used - always 0.
13	8192	Not used - always 0.
12	4096	Not used - always 0.
11	2048	Not used - always 0.
10	1024	Not used - always 0.
9	512	Not used - always 0.
8	256	Not used - always 0.
7	128	0 = instrument is not level correcting.
		1 =instrument is level correcting.
6	64	Not used - always 0.
5	32	Not used - always 0.
4	16	Not used - always 0.
3	8	Not used - always 0.
2	4	Not used - always 0.
1	2	0 = instrument is not settling.
		1 = instrument is settling.
0	1	0 = instrument is not calibrating.
		1 = instrument is calibrating.

See Also

STATus:OPERation[:EVENt]?
STATus:OPERation:ENABle
STATus:OPERation:PTRansition
STATus:OPERation:NTRansition
*STB?

`STATus:OPERation:ENABle` *number*

The "STATus:OPERation:ENABle" command sets the contents of the Operation Event Enable register.

The parameter is as follows:

number	The number representing the value of bits in the Operation Event Enable register to be set. The number must be from 0 to 32767.

The Operation Event Enable register contains a mask value for the bits to be enabled to set bit 7 in the status byte. A 1 in the Operation Event Enable register will enable the corresponding bit in the Operation Event register to set bit 7 in the status byte. A 0 will disable the bit.

The decimal value of each bit (the bit weight) in the Operation Event Enable register is shown in the following table.

Operation Event Enable Register Bit Definitions

Bit	Weight	Condition
15	32768	X - don't care.
14	16384	X - don't care.
13	8192	X - don't care.
12	4096	X - don't care.
11	2048	X - don't care.
10	1024	X - don't care.
9	512	X - don't care.
8	256	X - don't care.
7	128	0 = inhibit a "level correcting" event from setting bit 7 in the status byte. 1 = enable a "level correcting" event to set bit 7 in the status byte.
6	64	X - don't care.
5	32	X - don't care.
4	16	X - don't care.
3	8	X - don't care.
2	4	X - don't care.
1	2	0 = inhibit a "settling" event from setting bit 7 in the status byte. 1 = enable a "settling" event to set bit 7 in the status byte.
0	1	0 = inhibit a "calibrating" event from setting bit 7 in the status byte. 1 = enable a "calibrating" event to set bit 7 in the status byte.

Query Syntax

```
STATus:OPERation:ENABle?
```

Returned format:

number<NL>

Where:

- *number* ::= The current value of the Operation Event Enable register.

See Also

STATus:OPERation[:EVENt]?
STATus:OPERation:CONDition?
STATus:OPERation:PTRansition
STATus:OPERation:NTRansition
*STB?

STATus:OPERation[:EVENt]?

STATus:OPERation[:EVENt]?

The "STATus:OPERation[:EVENt]?" query returns the contents of the Operation Event register.

The Operation Event register holds a record of the state changes in the Operation Condition register that were defined in the Operation Edge Registers.

When you read the contents of the Operation Event register, the value returned is the total bit weights of all the bits that are high at the time you read it. When you read the contents of the Operation Event register using this command, the register is cleared (set to zero).

The decimal value of each bit (the bit weight) in the Operation Event register is shown in the following table.

Operation Event Register Bit Definitions

Bit	Weight	Condition
15	32768	Not used - always 0.
14	16384	Not used - always 0.
13	8192	Not used - always 0.
12	4096	Not used - always 0.
11	2048	Not used - always 0.
10	1024	Not used - always 0.
9	512	Not used - always 0.
8	256	Not used - always 0.
7	128	0 = a "level correcting" event has not occurred in the Operation Condition register that is defined by the Operation Edge registers. 1 = a "level correcting" event has occurred in the Operation Condition register that is defined by the Operation Edge registers.
6	64	Not used - always 0.
5	32	Not used - always 0.
4	16	Not used - always 0.
3	8	Not used - always 0.
2	4	Not used - always 0.
1	2	0 = a "settling" event has not occurred in the Operation Condition register that is defined by the Operation Edge registers. 1 = a "settling" event has occurred in the Operation Condition register that is defined by the Operation Edge registers.
0	1	0 = a "calibrating" event has not occurred in the Operation Condition register that is defined by the Operation Edge registers. 1 = a "calibrating" event has occurred in the Operation Condition register that is defined by the Operation Edge registers.

The Operation Event register is also set to 0 after the "*CLS" command is sent.

See Also

STATus:OPERation:CONDition?
STATus:OPERation:ENABle
STATus:OPERation:PTRansition
STATus:OPERation:NTRansition
*STB?

`STATus:OPERation:NTRansition` *number*

The "STATus:OPERation:NTRansition" command is used to define which bits in the Operation Condition register will set the corresponding bit in the Operation Event register on a one to zero state change.

The parameter is as follows:

number The number representing the value of bits in the Operation Negative Transition register to be set. The number must be from 0 to 32767.

The decimal value of each bit (the bit weight) in the Operation Negative Transition register is shown in the following table.

Operation Negative Transition Register Bit Definitions

Bit	Weight	Condition
15	32768	X - don't care.
14	16384	X - don't care.
13	8192	X - don't care.
12	4096	X - don't care.
11	2048	X - don't care.
10	1024	X - don't care.
9	512	X - don't care.
8	256	X - don't care.
7	128	0 = inhibit a one to zero state change of the "level correcting" bit from setting bit 7 in the Operation Event register. 1 = enable a one to zero state change of the "level correcting" bit to set bit 7 in the Operation Event register.
6	64	X - don't care.
5	32	X - don't care.
4	16	X - don't care.
3	8	X - don't care.
2	4	X - don't care.
1	2	0 = inhibit a one to zero state change of the "settling" bit from setting bit 1 in the Operation Event register. 1 = enable a one to zero state change of the "settling" bit to set bit 1 in the Operation Event register.
0	1	0 = inhibit a one to zero state change of the "calibrating" bit from setting bit 0 in the Operation Event register. 1 = enable a one to zero state change of the "calibrating" bit to set bit 0 in the Operation Event register.

Query Syntax

```
STATus:OPERation:NTRansition?
```

Returned format:

number<NL>

Where:

- *number* ::= The current value of the Operation Negative Transition register.

See Also

STATus:OPERation[:EVENt]?
STATus:OPERation:CONDition?
STATus:OPERation:ENABle
STATus:OPERation:PTRansition
*STB?

`STATus:OPERation:PTRansition` *number*

The "STATus:OPERation:PTRansition" command is used to define which bits in the Operation Condition register will set the corresponding bit in the Operation Event register on a zero to one state change.

The parameter is as follows:

number — The number representing the value of bits in the Operation Positive Transition register to be set. The number must be from 0 to 32767.

The decimal value of each bit (the bit weight) in the Operation Positive Transition register is shown in the following table.

Operation Positive Transition Register Bit Definitions

Bit	Weight	Condition
15	32768	X - don't care.
14	16384	X - don't care.
13	8192	X - don't care.
12	4096	X - don't care.
11	2048	X - don't care.
10	1024	X - don't care.
9	512	X - don't care.
8	256	X - don't care.
7	128	0 = inhibit a zero to one state change of the "level correcting" bit from setting bit 7 in the Operation Event register. 1 = enable a zero to one state change of the "level correcting" bit to set bit 7 in the Operation Event register.
6	64	X - don't care.
5	32	X - don't care.
4	16	X - don't care.
3	8	X - don't care.
2	4	X - don't care.
1	2	0 = inhibit a zero to one state change of the "settling" bit from setting bit 1 in the Operation Event register. 1 = enable a zero to one state change of the "settling" bit to set bit 1 in the Operation Event register.
0	1	0 = inhibit a zero to one state change of the "calibrating" bit from setting bit 0 in the Operation Event register. 1 = enable a zero to one state change of the "calibrating" bit to set bit 0 in the Operation Event register.

Query Syntax

```
STATus:OPERation:PTRansition?
```

Returned format:

number<NL>

Where:

- *number* ::= The current value of the Operation Positive Transition register.

See Also

STATus:OPERation[:EVENt]?
STATus:OPERation:CONDition?
STATus:OPERation:ENABle
STATus:OPERation:NTRansition
*STB?

`STATus:PRESet`

The "STATus:PRESet" command sets the following status registers to a known state:

Operation Event Enable register
Operation Negative Transition register
Operation Positive Transition register
Questionable Event Enable register
Questionable Negative Transition register
Questionable Positive Transition register

When the "STATus:PRESet" command is sent, the status registers are affected as shown in the following table.

Status Register Preset Conditions

Register	Preset Value
Operation Event Enable register	0
Operation Negative Transition register	0
Operation Positive Transition register	32767
Questionable Event Enable register	0
Questionable Negative Transition register	0
Questionable Positive Transition register	32767

See Also

STATus:OPERation[:EVENt]?
STATus:OPERation:CONDition?
STATus:OPERation:ENABle
STATus:OPERation:NTRansition
STATus:OPERation:PTRansition
STATus:QUEStionable[:EVENt]?
STATus:QUEStionable:CONDition?
STATus:QUEStionable:ENABle
STATus:QUEStionable:NTRansition
STATus:QUEStionable:PTRansition
*STB?

STATus:QUEStionable:CONDition?

```
STATus:QUEStionable:CONDition?
```

The "STATus:QUEStionable:CONDition?" query returns the contents of the Questionable Condition register.

The Questionable Condition register is constantly updated as questionable conditions change. No conditions are saved in this register.

When you read the contents of the Questionable Condition register, the value returned is the total bit weights of all the bits that are high at the time you read it. When you read the contents of the Questionable Condition register using this command, the contents of the register are not altered.

The decimal value of each bit (the bit weight) in the Questionable Condition register is shown in the following table.

Questionable Condition Register Bit Definitions

Bit	Weight	Condition
15	32768	Not used - always 0.
14	16384	Not used - always 0.
13	8192	Not used - always 0.
12	4096	Not used - always 0.
11	2048	Not used - always 0.
10	1024	Not used - always 0.
9	512	Not used - always 0.
8	256	0 = instrument is calibrated. 1 = instrument is un-calibrated.
7	128	0 = modulation circuitry is calibrated. 1 = modulation circuitry is un-calibrated.
6	64	Not used - always 0.
5	32	0 = frequency circuitry is locked. 1 = frequency circuitry is unlocked.
4	16	0 = internal frequency reference oven has reached operating temperature. 1 = internal frequency reference oven is cold.
3	8	0 = output power is calibrated or leveled. 1 = output power is un-calibrated or unleveled.
2	4	Not used - always 0.
1	2	Not used - always 0.
0	1	Not used - always 0.

See Also

STATus:QUEStionable[:EVENt]?
STATus:QUEStionable:ENABle
STATus:QUEStionable:PTRansition
STATus:QUEStionable:NTRansition
*STB?

STATus:QUEStionable:ENABle

`STATus:QUEStionable:ENABle` *number*

The "STATus:QUEStionable:ENABle" command sets the contents of the Questionable Event Enable register.

The parameter is as follows:

number	The number representing the value of bits in the Questionable Event Enable register to be set. The number must be from 0 to 32767.

The Questionable Event Enable register contains a mask value for the bits to be enabled to set bit 3 in the status byte. A 1 in the Questionable Event Enable register will enable the corresponding bit in the Questionable Event register to set bit 3 in the status byte. A 0 will disable the bit.

The decimal value of each bit (the bit weight) in the Questionable Event Enable register is shown in the following table.

Questionable Event Enable Register Bit Definitions

Bit	Weight	Condition
15	32768	Can't set.
14	16384	X - don't care.
13	8192	X - don't care.
12	4096	X - don't care.
11	2048	X - don't care.
10	1024	X - don't care.
9	512	X - don't care.
8	256	0 = inhibit an "instrument calibration" event from setting bit 3 in the status byte. 1 = enable an "instrument calibration" event to set bit 3 in the status byte.
7	128	X - don't care.
6	64	X - don't care.
5	32	0 = inhibit a "frequency circuitry lock" event from setting bit 3 in the status byte. 1 = enable a "frequency circuitry lock" event to set bit 3 in the status byte.
4	16	0 = inhibit a "reference oven temperature" event from setting bit 3 in the status byte. 1 = enable a "reference oven temperature" event to set bit 3 in the status byte.
3	8	0 = inhibit an "output power calibration" event from setting bit 3 in the status byte. 1 = enable an "output power calibration" event to set bit 3 in the status byte.
2	4	X - don't care.
1	2	X - don't care.
0	1	X - don't care.

Query Syntax

```
STATus:QUEStionable:ENABle?
```

Returned format:

number<NL>

Where:

- *number* ::= The current value of the Questionable Event Enable register.

See Also

STATus:QUEStionable[:EVENt]?
STATus:QUEStionable:CONDition?
STATus:QUEStionable:PTRansition
STATus:QUEStionable:NTRansition
*STB?

STATus:QUEStionable[:EVENt]?

The "STATus:QUEStionable[:EVENt]?" query returns the contents of the Questionable Event register.

The Questionable Event register holds a record of the state changes in the Questionable Condition register that were defined in the Questionable Edge Registers.

When you read the contents of the Questionable Event register, the value returned is the total bit weights of all the bits that are high at the time you read it. When you read the contents of the Questionable Event register using this command, the register is cleared (set to zero).

The decimal value of each bit (the bit weight) in the Questionable Event register is shown in the following table.

Questionable Event Register Bit Definitions

Bit	Weight	Condition
15	32768	Not used - always 0.
14	16384	Not used - always 0.
13	8192	Not used - always 0.
12	4096	Not used - always 0.
11	2048	Not used - always 0.
10	1024	Not used - always 0.
9	512	Not used - always 0.
8	256	0 = an "instrument calibration" event has not occurred in the Questionable Condition register that is defined by the Questionable Edge registers. 1 = an "instrument calibration" event has occurred in the Questionable Condition register that is defined by the Questionable Edge registers.
7	128	Not used - always 0.
6	64	Not used - always 0.
5	32	0 = a "frequency circuitry lock" event has not occurred in the Questionable Condition register that is defined by the Questionable Edge registers. 1 = a "frequency circuitry lock" event has occurred in the Questionable Condition register that is defined by the Questionable Edge registers.
4	16	0 = a "reference oven temperature" event has not occurred in the Questionable Condition register that is defined by the Questionable Edge registers. 1 = a "reference oven temperature" event has occurred in the Questionable Condition register that is defined by the Questionable Edge registers.
3	8	0 = an "output power calibration" event has not occurred in the Questionable Condition register that is defined by the Questionable Edge registers. 1 = an "output power calibration" event has occurred in the Questionable Condition register that is defined by the Questionable Edge registers.
2	4	Not used - always 0.
1	2	Not used - always 0.
0	1	Not used - always 0.

The Questionable Event register is also set to 0 after the "*CLS" command is sent.

See Also

STATus:QUEStionable:CONDition?
STATus:QUEStionable:ENABle
STATus:QUEStionable:PTRansition
STATus:QUEStionable:NTRansition
*STB?

`STATus:QUEStionable:NTRansition` *number*

The "STATus:QUEStionable:NTRansition" command is used to define which bits in the Questionable Condition register will set the corresponding bit in the Questionable Event register on a one to zero state change.

The parameter is as follows:

number	The number representing the value of bits in the Questionable Negative Transition register to be set. The number must be from 0 to 32767.

The decimal value of each bit (the bit weight) in the Questionable Negative Transition register is shown in the following table.

Questionable Negative Transition Register Bit Definitions

Bit	Weight	Condition
15	32768	Can't set.
14	16384	X - don't care.
13	8192	X - don't care.
12	4096	X - don't care.
11	2048	X - don't care.
10	1024	X - don't care.
9	512	X - don't care.
8	256	0 = inhibit a one to zero state change of the "instrument calibration" bit from setting bit 8 in the Questionable Event register. 1 = enable a one to zero state change of the "instrument calibration" bit to set bit 8 in the Questionable Event register.
7	128	X - don't care.
6	64	X - don't care.
5	32	0 = inhibit a one to zero state change of the "frequency circuitry lock" bit from setting bit 5 in the Questionable Event register. 1 = enable a one to zero state change of the "frequency circuitry lock" bit to set bit 5 in the Questionable Event register.
4	16	0 = inhibit a one to zero state change of the "reference oven temperature" bit from setting bit 4 in the Questionable Event register. 1 = enable a one to zero state change of the "reference oven temperature" bit to set bit 4 in the Questionable Event register.
3	8	0 = inhibit a one to zero state change of the "output power calibration" bit from setting bit 3 in the Questionable Event register. 1 = enable a one to zero state change of the "output power calibration" bit to set bit 3 in the Questionable Event register.
2	4	X - don't care.
1	2	X - don't care.
0	1	X - don't care.

Query Syntax

```
STATus:QUEStionable:NTRansition?
```

Returned format:

number<NL>

Where:

- *number* ::= The current value of the Questionable Negative Transition register.

See Also

STATus:QUEStionable[:EVENt]?
STATus:QUEStionable:CONDition?
STATus:QUEStionable:ENABle
STATus:QUEStionable:PTRansition
*STB?

`STATus:QUEStionable:PTRansition` *number*

The "STATus:QUEStionable:PTRansition" command is used to define which bits in the Questionable Condition register will set the corresponding bit in the Questionable Event register on a zero to one state change.

The parameter is as follows:

number	The number representing the value of bits in the Questionable Positive Transition register to be set. The number must be from 0 to 32767.

The decimal value of each bit (the bit weight) in the Questionable Positive Transition register is shown in the following table.

Questionable Positive Transition Register Bit Definitions

Bit	Weight	Condition
15	32768	Can't set.
14	16384	X - don't care.
13	8192	X - don't care.
12	4096	X - don't care.
11	2048	X - don't care.
10	1024	X - don't care.
9	512	X - don't care.
8	256	0 = inhibit a zero to one state change of the "instrument calibration" bit from setting bit 8 in the Questionable Event register. 1 = enable a zero to one state change of the "instrument calibration" bit to set bit 8 in the Questionable Event register.
7	128	X - don't care.
6	64	X - don't care.
5	32	0 = inhibit a zero to one state change of the "frequency circuitry lock" bit from setting bit 5 in the Questionable Event register. 1 = enable a zero to one state change of the "frequency circuitry lock" bit to set bit 5 in the Questionable Event register.
4	16	0 = inhibit a zero to one state change of the "reference oven temperature" bit from setting bit 4 in the Questionable Event register. 1 = enable a zero to one state change of the "reference oven temperature" bit to set bit 4 in the Questionable Event register.
3	8	0 = inhibit a zero to one state change of the "output power calibration" bit from setting bit 3 in the Questionable Event register. 1 = enable a zero to one state change of the "output power calibration" bit to set bit 3 in the Questionable Event register.
2	4	X - don't care.
1	2	X - don't care.
0	1	X - don't care.

Query Syntax

```
STATus:QUEStionable:PTRansition?
```

Returned format:

number<NL>

Where:

- *number* ::= The current value of the Questionable Positive Transition register.

See Also

STATus:QUEStionable[:EVENt]?
STATus:QUEStionable:CONDition?
STATus:QUEStionable:ENABle
STATus:QUEStionable:NTRansition
*STB?

*STB? (Read Status Byte Query)

```
*STB?
```

The "*STB?" query returns the current value of the synthesizer status byte.

When you read the contents of the status byte, the value returned is the total bit weights of all the bits that are high at the time you read it. When you read the contents of the status byte using the "*STB?" query, the status byte is not cleared.

The decimal value of each bit (the bit weight) in the status byte is shown in the following table.

Status Byte Bit Definitions

Bit	Weight	Name	Condition
7	128	OPER	0 = no operation status events have occurred. 1 = an operation status event has occurred.
6	64	RQS/MSS	0 = instrument has no reason for service. 1 = instrument is requesting service.
5	32	ESB	0 = no event status conditions have occurred. 1 = an enabled event status condition has occurred.
4	16	MAV	0 = no output messages are ready. 1 = an output message is ready.
3	8	QUES	0 = no questionable conditions have occurred. 1 = a questionable condition has occurred.
2	4	-	Not used - always 0.
1	2	-	Not used - always 0.
0	1	-	Not used - always 0.

The MSS (Master Summary Status) bit and not RQS is reported on bit 6. The MSS indicates whether or not the device has at least one reason for requesting service. To read the status byte with RQS reported on bit 6, use the HP-IB serial poll.

At power-up, the status byte is momentarily cleared (set to 0). After being cleared, the status registers will report their bit values.

See Also

*CLS
*ESE
*ESR?
*SRE

3

Error Messages

Error Messages

If an error condition occurs in the synthesizer, it will always be reported to both the front panel and HP-IB error queues. These two queues are viewed and managed separately. The [MSG] key is used to view the contents of the front panel error queue. The HP-IB query "SYSTem:ERRor?" is used to view the contents of the HP-IB error queue.

If there are any error messages in the front panel error queue, the front panel MSG annunciator will be lit. Pressing the [MSG] key repeatedly until the MSG annunciator turns off will empty the front panel error queue. The [MSG] key has no affect on the HP-IB error queue. Emptying the HP-IB error queue has no affect on the front panel queue, therefore, it will not affect the MSG annunciator.

There are some special error types that are called permanent errors. Permanent errors remain in the error queues until the error condition is cleared. Pressing the [MSG] key will empty the front panel error queue, but the permanent errors will be re-reported if the error conditions still exist. In the HP-IB error queue, the permanent errors are re-reported after the message, 0,"No error" is read using the "SYSTem:ERRor?" query or after the "*CLS" command is executed.

Error Messages List

The list of error messages in this chapter lists all of the error messages associated with synthesizer operation. An example of the error format found in the list of error messages is as follows:

2003 −222,"Data out of range;CW FREQ(2003)"

Select a CW frequency that is within range of the installed options. If other modules or options are installed that extend the CW frequency range of the signal generator, this frequency range will be extended also.

The following explains each element of an error message listing.

- **Manual Error Number** – The number 2003 to the left and in the parenthesis is called the manual error number. The error message list is organized in ascending order off the manual error number. The manual error number will always be found in the parenthesis contained in the message.
- **Error Message** – The bold text **−222,"Data out of range;CW FREQ(2003)"** is the error message. When the [MSG] key is pressed, the error message is displayed in the left-most display. The entire message is returned by the HP-IB query "SYSTem:ERRor?". The error message contains the following parts:
  - **SCPI Error Number** – The standard SCPI error number (−222 in the example) usually differs from the manual error number because the manual error number is unique for every possible message. Standard SCPI error numbers are always negative (except for 0, "No error"). If there is no standard SCPI error number for a message, the manual error number replaces it in the error message.
  - **SCPI Error Message** – The SCPI error message is **Data out of range** in the example.
  - **Detailed Description** – All information after the semicolon is a detailed description of what exactly caused the error. In the example, **CW FREQ** tells you that CW frequency was out of range. If no detailed description exists, it will be omitted from the message.

- Action Required – The text that appears below each error message listing contains corrective actions that should be followed in order to correct the error condition.

Notes

1. For more information related to error messages, refer to "To Read the Contents of the Error Queue" in Chapter 2 or the "MSG" reference entry in Chapter 6 of the *HP 83711A/12A and HP 83711B/12B Synthesized CW Generators User's Guide*, and the "SYSTem:ERRor?" reference entry in Chapter 1 of this manual.
2. Error messages related to hardware failures are listed in the *HP 83711A/12A and HP 83711B/12B Synthesized CW Generators Service Guide* (HP part number 83711-90134).

The following pages list all error messages in ascending manual error number order

−440 **−440,"Query UNTERMINATED after indefinite response;(−440)"**

Correct the HP-IB controller program so that the query that returns indefinite length block data is the last item on the program line.

−430 **−430,"Query DEADLOCKED;(−430)"**

Correct the HP-IB controller program so that no more than eight queries are executed within the same line of the program.

−420 **−420,"Query UNTERMINATED;(−420)"**

Correct the HP-IB controller program so that the controller terminates commands with the newline character (NL) before the controller attempts to read query response data.

−410 **−410,"Query INTERRUPTED;(−410)"**

Check the HP-IB controller program to see if the controller is programmed to read the entire query response data before issuing a subsequent command.

−400 **−400,"Query error;(−400)"**

Some problem occurred while parsing an HP-IB query. Insure that your programming is correct and try the query again. Look at −440 through −400 for types of problems to look for.

−350 **−350,"Queue overflow"**

The error queue overflowed at this point and this message replaced the 16th error message. No action is required. Note: To clear the HP-IB error queue, use *CLS.

−330 **−330,"Self-test failed;(−330)"**

See the explanation for error number 4000.

−315 **−315,"Configuration memory lost;(−315)"**

See error 1803.

−314 −314,"Save/recall memory lost;(−314)"

See error 1803.

−311 −311,"Memory error;(−311)"

See error 1803.

−310 −310,"System error;(−310)"

Some problem occurred while parsing an HP-IB command or query. Insure that your programming is correct and try the command again.

−300 −300,"Device specific error;(−300)"

A remote command or query could not be executed because an error occurred in the synthesizer.

−278 −278,"Macro header not found;(−278)"

A *GMC? or *RMC macro label could not be found in the list of defined macro labels. Use *LMC? to get a list of all the currently defined macro labels.

−277 −277,"Macro redefinition not allowed;(−277)"

Indicates that a macro label in the *DMC command could no be defined because the macro label was already defined.

−276 −276,"Macro recursion error;(−276)"

The nesting/recursion of macros is deeper than 4 levels. Don't use more than 4 levels when defining macros of macros.

−275 −275,"Macro definition too long;(−275)"

The macro definition must be 255 characters or less.

−274 −274,"Macro parameter error;(−274)"

A macro parameter placeholder was improperly used.

−273 −273,"Illegal macro label;(−273)"

Indicates that a macro label defined in the *DMC command has a legal string syntax; but, it is too long. It is the same as a common command header, or contain invalid header syntax.

−272 **−272,"Macro execution error;(−272)"**

Indicates that a syntactically legal macro program data sequence could not be executed due to some error in the macro definition.

−271 **−271,"Macro syntax error;(−271)"**

Indicates that a syntax error exists in the macro definition.

−270 **−270,"Macro error;(−270)"**

An error occurred while attempting to define, query or use a macro. Check that the macros are correct using *LMC? and *GMC?.

−261 **−261,"Math error in expression;(−261)"**

An expression could not be evaluated due to a math error; for example, a divide-by-zero was attempted.

−260 **−260,"Expression error;(−260)"**

An expression could not be evaluated because it contains an error.

−241 **−241,"Hardware missing;(−241)"**

The requested hardware does not exist in the synthesizer. Use *OPT? to check which options are installed.

−240 **−240,"Hardware error;(−240)"**

The remote command or query could not be executed because of a hardware error.

−226 **−226,"Tables not same length;(−226)"**

See error 731.

−225 **−225,"Out of memory;(−225)"**

The synthesizer has run out of memory. The memory requested has not been allocated.

−224 **−224,"Illegal parameter value;(−224)"**

Correct the HP-IB controller program so that the data included with the HP-IB command is an acceptable parameter for the command.

−223 −223,"Too much data;(−223)"

Correct the HP-IB controller program so that there is less data on a single command line. The synthesizer does not have enough memory to buffer it all.

−222 −222,"Data out of range;(−222)"

The parameter data was out of range. Unlike other −222 errors, details are not known about the command or query which caused this error.

−221 −221,"Settings conflict;(−221)"

The current synthesizer state does not allow the remote command or query to be executed.

−220 −220,"Parameter error;(−220)"

The parameter included with the remote command or query is incorrect.

−213 −213,"Init ignored;(−213)"

Indicates that an initiate was ignored because a trigger was already in progress.

−212 −212,"Arm ignored;(−212)"

An arming signal was received and recognized but was ignored.

−211 −211,"Trigger ignored;(−211)"

A GET, *TRG or triggering signal was received and recognized but was ignored. Currently, there is no bus trigger capability in the synthesizer.

−210 −210,"Trigger error;(−210)"

A trigger error occurred in the synthesizer.

−201 −201,"Invalid while in local;(−201)"

The remote command or query cannot be executed when the synthesizer is in local mode.

−200 −200,"Execution error;(−200)"

Some problem occurred while executing an HP-IB command or query. Insure that your programming is correct and try the command again.

−184 **−184,"Macro parameter error;(−184)"**

Indicates that a command inside the macro definition had the wrong number or type of parameters.

−183 **−183,"Invalid inside macro definition;(−183)"**

Indicates that the program message sequence sent with *DMC or *DDT command, is syntactically invalid.

−181 **−181,"Invalid outside macro definition;(−181)"**

Indicates that a macro parameter placeholder was encountered outside of the macro definition.

−180 **−180,"Macro error;(−180)"**

An error occurred while attempting to define, query or use a macro. Check that the macros are correct using *LMC? and *GMC?.

−178 **−178,"Expression data not allowed;(−178)"**

Correct the HP-IB controller program so that the data included with the HP-IB command does not contain parentheses.

−171 **−171,"Invalid expression;(−171)"**

The expression contained a syntax error like unmatched parenthesis or an illegal character.

−170 **−170,"Expression error;(−170)"**

The expression contains a syntax error.

−168 **−168,"Block data not allowed;(−168)"**

Correct the HP-IB controller program so that the data included with the HP-IB command does not contain block data (no # character).

−161 **−161,"Invalid block data;(−161)"**

Correct the HP-IB controller program so that it contains a correct block data type. A block data type should begin with "#" followed by a number.

−160 **−160,"Block data error;(−160)"**

The block data contains a syntax error.

−158 **−158,"String data not allowed;(−158)"**

Correct the HP-IB controller program so that the data included with the HP-IB command does not contain string data (no single or double quote characters).

−151 **−151,"Invalid string data;(−151)"**

Correct the HP-IB controller program so that the string data included with the HP-IB command is terminated with a single or double quote. The terminating quote must be the same as the leading quote of the string. A string can also be valid if invalid characters are contained in it.

−150 **−150,"String data error;(−150)"**

The string data was too long to be buffered in the synthesizer string data area.

−148 **−148,"Character data not allowed;(−148)"**

Correct the HP-IB controller program so that the data included with the HP-IB command is not character data.

−144 **−144,"Character data too long;(−144)"**

The character data element contains more than 12 characters.

−141 **−141,"Invalid character data;(−141)"**

Either the character data element contains an invalid character or the particular element is not valid for the command or query.

−140 **−140,"Character data error;(−140)"**

The character data contains a syntax error.

−138 **−138,"Suffix not allowed;(−138)"**

Correct the HP-IB controller program so that the decimal data included with the HP-IB command does not use a suffix. Use exponential notation instead.

−134 **−134,"Suffix too long;(−134)"**

The suffix contained more than 12 characters.

−131 **−131,"Invalid suffix;(−131)"**

Correct the HP-IB controller program so that the decimal data included with the HP-IB command contains a valid suffix for that command or query.

−130 **−130,"Suffix error;(−130)"**

The suffix contains a syntax error.

−128 **−128,"Numeric data not allowed;(−128)"**

Correct the HP-IB controller program so that the data included with the HP-IB command is not numeric data.

−124 **−124,"Too many digits;(−124)"**

The mantissa of a decimal numeric data element contained more than 255 digits excluding leading zeros.

−123 **−123,"Exponent too large;(−123)"**

The magnitude of the exponent was larger than 32000.

−121 **−121,"Invalid character in number;(−121)"**

Correct the HP-IB controller program so that the decimal data or non-decimal numeric included with the HP-IB command contains the correct numeric characters.

−120 **−120,"Numeric data error;(−120)"**

An invalid numeric or non-decimal numeric was parsed but it was syntactically invalid.

−114 **−114,"Header suffix out of range;(−114)"**

Indicates that a header suffix was too large.

−113 **−113,"Undefined header;(−113)"**

The header is syntactically correct, but it is undefined for the Synthesizer.

−112 **−112,"Program mnemonic too long;(−112)"**

The header contains more than 12 characters.

−111 **−111,"Header separator error;(−111)"**

An illegal header separator was encountered while parsing the header.

−110 −110,"Command header error;(−110)"

An error was detected in the header.

−109 −109,"Missing parameter;(−109)"

This error indicates that an HP-IB command or query has too few parameters. Correct the HP-IB controller program so that the HP-IB command or query contains the correct number of parameters.

−108 −108,"Parameter not allowed;(−108)"

This error indicates that an HP-IB command or query has too many parameters. Correct the HP-IB controller program so that the HP-IB command or query contains the correct number of parameters.

−105 −105,"GET not allowed;(−105)"

Correct the HP-IB controller program so that the group execute trigger does not occur within a line of HP-IB program code.

−104 −104,"Data type error;(−104)"

The parser recognized a data element different than one allowed. For example, numeric or string data was expected but block data was encountered.

−103 −103,"Invalid separator;(−103)"

A separator was expected but an illegal character was encountered. For example, the space is missing from the following: FREQ.01GHz.

−102 −102,"Syntax error;(−102)"

An unrecognized command or data type was encountered.

−101 −101,"Invalid character;(−101)"

A syntactic element contains a character which is invalid for that type. For example, a header containing an ampersand would give this error.

−100 −100,"Command error;(−100)"

Some problem occurred while parsing an HP-IB command or query. Insure that your programming is correct and try the command again.

0 0,"No error"

The error queue contains no errors.

110 **110,"EEPROM unprotected;(110)"**

The PG switch is set to 0 which leaves the EEPROM unprotected. Open up the synthesizer and switch the PG switch to 1. This error message is only a warning.

511 **511,"YTO cal data init error;(511)"**

The YIG oscillator factory calibration data checksum was incorrect. A new YIG calibration should be performed or else the instrument may be unable to attain lock at some frequencies.

600 **600,"ALC loop went unleveled;(600)"**

Power is set to a level that is higher than the instrument can supply. This is usually due to attenuator hold and the power is set to a value that requires the vernier to be operating out of its specified range. Change the power level or turn off attenuator hold. This is a "permanent" error.

601 **601,"Hardware driver Power limit;(601)"**

Due to instrument specials such as attenuator hold, the circuits cannot supply the specified power. Change the power level or turn off attenuator hold. This is a "permanent" error.

602 **602,"Vernier has been set to the limit;(602)"**

Due to instrument options such as attenuator hold, the circuits cannot supply the specified power. The vernier has been limited to a valid value. Change the power level or turn off attenuator hold. This is a "permanent" error.

603 **603,"RF on/off command not valid;(603)"**

An invalid request to turn off RF power was ignored by the instrument.

604 **604,"Atten driver error while setting level;(604)"**

The attenuators could not be set to the range requested. Change output power to a valid setting.

605 **605,"Vernier driver error while setting level;(605)"**

The vernier value requested was not possible. Change output power to a valid setting.

606 606,"Level is not in guaranteed range.;(606)"

The power level requested is beyond specifications and may be invalid. This could be due to a very low vernier setting required when attenuator hold is active. This is a "permanent" error.

608 608,"Attenuator not set before Ext Meter mode;(608)"

The attenuator range must match that of the meter range desired for external meter ALC mode. Turn off attenuator hold mode and make sure the power meter is in range hold before entering external power meter mode.

610 610,"Track and hold failed, level is invalid;(610)"

Power level was too high to do a power level setting in pulse or scan AM mode. Try setting power to a lower value.

611 611,"Track and hold failed, level is invalid;(611)"

Power level was too high to do a power level setting in pulse or scan AM mode. Try setting power to a lower value.

650 650,"PG switch not set to 0;(650)"

ALC calibration data was not saved in EEPROM because the PG switch was protecting the EEPROM from "writes". Open up the synthesizer and switch the PG switch to 0.

651 651,"Invalid vernier cal data for 1-20 GHz;(651)"

Valid vernier calibration data is not available for the 1-20 GHz band. If you need to use this frequency range, see the explanation for error number 4000.

652 652,"ALC term verification after EEPROM write;(652)"

ALC vernier calibration data was not written into EEPROM correctly. Try writing the data into the synthesizer again.

653 653,"Invalid vernier cal data for 0.01-1 GHz;(653)"

Valid vernier calibration data is not available for the 0.01-1 GHz band. If you need to use this frequency range, see the explanation for error number 4000.

655 655,"PG switch not set to 0;(655)"

Factory frequency correction data was not saved in EEPROM because the PG switch was protecting the EEPROM from "writes". Open up the synthesizer and switch the PG switch to 0.

656 656,"Factory flatness cal data verification;(656)"

Factory frequency level calibration data was not written into EEPROM correctly. Try writing the data into the synthesizer again.

657 657,"Factory flatness cal data is invalid;(657)"

A valid factory frequency level calibration is not available for one or more of the frequency bands and/or attenuator settings. See the explanation for error number 4000.

670 670,"Meter power input is out of range;(670)"

The ALC input is not a valid level. The power meter range may be wrong. This is a "permanent" error.

700 700,"Hardware driver Frequency limit;(700)"

The frequency entered cannot be generated by the synthesizer with the set of options available.

701 701,"Lo synthesizer set error;(701)"

The LO synthesizer cannot be set to the level requested. Enter a new frequency.

702 702,"Offset synthesizer set error;(702)"

The offset synthesizer cannot be set to the level requested. Enter a new frequency.

704 704,"YTO driver set error;(704)"

The YIG oscillator cannot be set to the level requested. Enter a new frequency.

706 706,"Low pass filter set error;(706)"

The low pass filter cannot be set to the requested setting. Enter a new frequency.

709 709,"Hardware driver Frequency limit;(709)"

The frequency entered cannot be generated by the Frequency Extension module.

710 710,"LO synthesizer went out of lock;(710)"

The LO synthesizer went out of lock. This may be due to hookup or disconnection of an external time base. Enter a different RF frequency and then set the frequency back to the desired value to re-lock. This is a "permanent" error.

711 711,"Offset synthesizer went out of lock;(711)"

The offset synthesizer board was unable to attain lock. Enter a different RF frequency and then set the frequency back to the desired value to re-lock. This is a "permanent" error.

712 712,"Frequency loop went out of lock;(712)"

Enter a different RF frequency and then set the frequency back to the desired value to re-lock. This is a "permanent" error.

713 713,"Possible FM overmodulation;(713)"

Reduce the level of the modulating signal into the FM IN connector.

714 714,"Possible PM overmodulation (714)"

Reduce the level of the modulating signal into the FM/ϕ IN connector.

730 730,"Invalid data in level correct table;(730)"

The active level correction table has no data in it. Select a level correction table with valid data, perform an automatic level correction to get valid data into the active table, or use HP-IB to load the active table. This is a "permanent" error.

731 −226,"Tables not same length;Level correct(731)"

The active level correction table has a mismatch between the number of frequencies stored and the number of losses stored. Select a level correction table with valid data, perform an automatic level correction to get valid data into the active table, or use HP-IB to load tables with the same length. This is a "permanent" error.

732 **732,"Same frequencies with different losses;(732)"**

The active level correction table has duplicate frequencies with different losses. Select a level correction table with valid data, perform an automatic level correction to get valid data into the active table, or use HP-IB to load tables with non-duplicate frequencies. This is a "permanent" error.

733 **733,"Frequency table not in ascending order;(733)"**

The MEM:TABL:FREQ command did not contain frequencies in ascending order. The whole MEM:TABL:FREQ command was rejected, leaving the old selected table unaltered.

734 **734,"Frequency table not in ascending order;(734)"**

The active level correction table does not contain frequencies in ascending order. Select a level correction table with valid data, perform an automatic level correction to get valid data into the active table, or use HP-IB to load a table with ascending ordered frequencies. This is a "permanent" error.

735 **735,"Level correct points less than 2;(735)"**

The number of points in a level correction table must be from 2 to 401. Either too few points were entered or duplicate frequencies caused the number of "real" points to shrink below 2.

736 **736,"Factory level corr 1-20 GHz, 1-9 table;(736)"**

Factory frequency level correction data for 1-20 GHz band, non-thru paths are not valid. If you need to use this frequency range and you are using a step attenuator, see the explanation for error number 4000.

737 **737,"Factory level corr 0.01-1 GHz, 1-9 table;(737)"**

Factory frequency level correction data for 0.01-1 GHz band, non-thru paths are not valid. If you need to use this frequency range and you are using a step attenuator, see the explanation for error number 4000.

738 **738,"Factory level corr 0.01-1 GHz, 0 dB table;(738)"**

Factory frequency level correction data for 0.01-1GHz band, thru path is not valid. If you need to use this frequency range and you work with output levels that don't use the step attenuator, see the explanation for error number 4000.

739 **739,"Invalid data in table, not recalled;(739)"**

This error indicates that a level correction table recall failed. Try selecting the same level correction table again. If this error message persists you will have to recreated the saved table.

740 **740,"Another controller is on the HP-IB bus;(740)"**

An automatic level correction was attempted but failed because there is a controller on the HP-IB bus. Remove all controllers from the HP-IB bus and try again.

741 **741,"No HP-IB devices found;(741)"**

An automatic level correction was attempted but failed to find any other devices on the HP-IB bus. Connect the desired power meter to the HP-IB bus and try again. Check the HP-IB cable(s) for loose connections.

742 **742,"Errors in cleanup of HP-IB;(742)"**

When exiting the automatic level correction, the synthesizer failed to finish resetting the HP-IB bus and presetting the power meter. Make sure the power meter address matches the power meter address setting on the signal generator. Check the HP-IB cable(s) for loose connections.

743 **743,"No HP-IB devices found;(743)"**

An automatic level correction was attempted but failed to find any other devices on the HP-IB bus. Connect the desired power meter to the HP-IB bus and try again. Make sure the power meter address matches the power meter address setting on the synthesizer. Check the HP-IB cable(s) for loose connections.

744 **744,"Cannot find power meter on HP-IB bus;(744)"**

An automatic level correction was attempted but failed to find a power meter on the HP-IB bus. Connect the desired power meter to the HP-IB bus and try again. Make sure the power meter address matches the power meter address setting on the signal generator. Check the HP-IB cable(s) for loose connections.

745 **745,"Meter returns error msg;(745)"**

While running the automatic level correction, the power meter returned +9.0000E+40 as the power reading. This number indicates an error within the power meter.

746 **746,"Data measured is invalid or out of range;(746)"**

While running the automatic level correction, the power meter returned an out of range power reading or the power meter returned a non-number as its power reading. Check that the power meter is reading an appropriate value by looking at it.

747 **747,"Unable to receive msg from meter;(747)"**

An automatic level correction was attempted but failed to power readings back from the power meter. Make sure the power meter address matches the power meter address setting on the synthesizer. Check the HP-IB cable(s) for loose connections.

748 **748,"Erasing corrupted level correct table;(748)"**

A level correction table was corrupt and was erased to fix it.

749 **749,"Frequency not within level correct data;(749)"**

This message is a warning that the current CW frequency is not contained within the frequencies in the active level correction table. Therefore, the correction applied to the output will be 0 dB. This is a "permanent" error.

751 **751,"Parameters cause points to be too large;(751)"**

The level correction parameters cannot define a new table because they create too many level correction points.

752 **−222,"Data out of range;Data set to minimum(752)"**

Loss data must be in the range of −40 to +40 dB.

753 **−222,"Data out of range;Data set to maximum(753)"**

Loss data must be in the range of −40 to +40 dB.

754 **754,"Total points reduced from that requested;(754)"**

The number of points requested for an automatic level correction has been reduced to avoid duplicate frequencies.

755 **755,"Invalid data in active table, not saved;(755)"**

This error indicates that a level correction table save failed. Try selecting the same level correction table again. If this error message persists you will have to recreated the table.

756 **756,"Factory level corr 1-20 GHz, 0 dB table;(756)"**

Factory frequency level correction data for 1-20 GHz band, thru path is not valid. If you need to use this frequency range and you work with output levels that don't use the step attenuator, see the explanation for error number 4000.

757 **757,"Bad attenuator setting parameter;(757)"**

The attenuator range for looking up factory frequency level correction data, is 0 through 120 (resolution is 10).

758 **−222,"Data out of range;Data set to minimum(758)"**

Loss data for factory frequency level correction was less than minimum.

759 **−222,"Data out of range;Data set to maximum(759)"**

Loss data for factory frequency level correction was more than maximum.

760 **760,"Bad index into data table;(760)"**

A data lookup from a calibration table found that the index data is out of range. Try setting the same Synthesizer function again. If this error message persists, run the instrument self-test.

761 **761,"Bad index into offset table;(761)"**

A data lookup from the factory level correction offset table found that the index data is out of range. Try setting the same Synthesizer function again. If this error message persists, run the instrument self-test.

763 **763,"Unable to write to EEPROM;(763)"**

A calibration table was not loaded into EEPROM because the EEPROM was protected or the EEPROM load did not verify. Open up the synthesizer and switch the PG switch to 0.

764 **764,"Unable to write to RAM;(764)"**

A write to RAM failed to verify. Run the self-test routine to check RAM for problems.

765 **765,"Attempt to write to ROM;(765)"**

There was an attempt to write calibration data to ROM. This should not occur, but if it does, try setting the same Synthesizer function again. If this error message persists, run the instrument self-test.

766 **766,"Number of writes to EEPROM exceeds max;(766)"**

The number of EEPROM writes has exceeded the maximum allowed. However, the data was written to the EEPROM anyway. This is only a warning; but, you should check to make sure your data was correctly stored in EEPROM.

770 **770,"YTO cal data invalid;(770)"**

The YIG oscillator factory calibration data checksum was incorrect. Select the CAL YIG OSC feature to perform a YIG oscillator calibration. If you do not re-calibrate, the synthesizer may be unable to attain lock at some frequencies.

771 **771,"Invalid YIG DAC value in cal table.;(771)"**

The YIG oscillator factory calibration data checksum was incorrect. Select the CAL YIG OSC feature to perform a YIG oscillator calibration. If you do not re-calibrate, the synthesizer may be unable to attain lock at some frequencies.

772 **772,"YTO cal values for Up/Down search vary;(772)"**

The YIG oscillator factory calibration data checksum was incorrect. Select the CAL YIG OSC feature to perform a YIG oscillator calibration. If you do not re-calibrate, the synthesizer may be unable to attain lock at some frequencies.

774 **774,"EEPROM protected, YTO cal aborted;(774)"**

An automatic YIG oscillator calibration was not performed because the PG switch was protecting the EEPROM from "writes". Open up the synthesizer and switch the PG switch to 0.

775 775,"Low band yto cal failed;(775)"

The low band calibration failed and the data for the calibration was not saved. Re-try the YIG calibration and watch for the default cal points indicated when the DAC value shown for a given point says 'dflt = ' instead of 'DAC = '.

776 776,"High band yto cal failed;(776)"

The low band calibration failed and the data for the calibration was not saved. Re-try the YIG calibration and watch for the default cal points indicated when the DAC value shown for a given point says 'dflt = ' instead of 'DAC = '.

777 777,"Low band yto cal could not write EEPROM;(777)"

The data for the low band YIG calibration could not be written to EEPROM. Make sure the PG switch on the processor board was closed during the cal and re-try the YIG calibration.

778 778,"High band yto cal could not write EEPROM;(778)"

The data for the low band YIG calibration could not be written to EEPROM. Make sure the PG switch on the processor board was closed during the cal and re-try the calibration.

779 779,"Only 2GHz or 10GHz allowed for YTO Cal;(779)"

The start frequency specified for the CAL:YIG:FREQ:START command was not valid. Re-enter the start frequency and start the YIG calibration again.

785 785,"Cal Data not saved, PG switch is not 0;(785)"

The calibration data could not be saved because the PG switch on the microprocessor board was not closed. Close the PG switch and do the calibration again.

786 786,"Cal Data verification after EEPROM write;(786)"

The calibration data was not written correctly after the calibration. Close the PG switch and do the calibration again.

787 787,"FM cal and Pinchoff cal not initialized;(787)"

The YIG calibration has not been done for both YIG bands or else the pinchoff cal values have not been entered yet.

790 **790,"Scan-mod 0.01-1 GHz gain tables bad;(790)"**

Checksum was invalid for the AM gain tables. If you need to use this frequency range and scan AM modulation, see the explanation for error number 4000.

793 **793,"Scan AM cal not valid, defaults used;(793)"**

Scan AM level may be in error due to invalid calibration data. If you need to use scan AM modulation, see the explanation for error number 4000.

794 **794,"Scan-mod 1-20 GHz gain tables bad;(794)"**

Checksum was invalid for the AM scan gain tables. If you need to use this frequency range and scan AM modulation, see the explanation for error number 4000.

795 **795,"Scan-mod 1-20 GHz linear 1 tables bad;(795)"**

Checksum was invalid for the AM scan linear 1 tables. If you need to use this frequency range and scan AM modulation, see the explanation for error number 4000.

796 **796,"Scan-mod 1-20 GHz linear 2 tables bad;(796)"**

Checksum was invalid for the AM scan linear 2 tables. If you need to use this frequency range and scan AM modulation, see the explanation for error number 4000.

800 **800,"Options not saved, PG switch is not 0;(800)"**

The instrument option bit-fields were not saved to EEPROM. Open up the synthesizer, switch the PG switch to 0, and try setting the option bit-fields again.

801 **801,"Serial num not saved, PG switch is not 0;(801)"**

The instrument serial number was not saved to EEPROM. Open up the synthesizer, switch the PG switch to 0, and try setting the serial number again.

802 **802,"Assembly Revs not saved, PG switch is not 0 (802)"**

The protection switch on the CPU board is in an incorrect position to change EEPROM data.

803 803,"EEPROM not cleared, PG switch is not 0 (803)"

The protection switch on the CPU board is in an incorrect position to clear EEPROM data.

900 900,"PRI increased to fit pulse width;(900)"

The current pulse width is too large for the current PRI. The PRI is increased to allow for the pulse width. This is a "permanent" error.

901 901,"Delay and width decreased to fit max PRI;(901)"

The current pulse width plus the current pulse delay is too large because they are greater than the maximum PRI. The delay and/or the width were reduced to fit. This is a "permanent" error.

940 940,"Oven is cold;(940)"

The high stability time base oven is cold. The oven must be allowed to warm up before proper instrument operation will occur. This is a "permanent" error.

944 944,"Reference synthesizer went out of lock;(944)"

The reference synthesizer went out of lock. The out of lock condition may have been due to an external time base being connected or disconnected. Enter a different RF frequency and then set the frequency back to the desired value to re-lock. This is a "permanent" error.

1101 1101,"Loop number is invalid.;(1101)"

If you are using the direct hardware control service feature, you have entered an out of range value. If this error occurs while not using the direct hardware control service feature, low level hardware drivers could not set the requested synthesizer setting. Try setting the synthesizer again. If this error message persists, run the instrument self-test.

1102 1102,"Start bit is negative.;(1102)"

See the explanation for error number 1101.

1103 1103,"Length less than 0 or more than 32;(1103)"

See the explanation for error number 1101.

1104 1104,"Start bit is invalid for given loop.;(1104)"

See the explanation for error number 1101.

1105 1105,"Length is invalid for given loop;(1105)"

See the explanation for error number 1101.

1106 1106,"Data is too large for given length;(1106)"

See the explanation for error number 1101.

1107 −222,"Data out of range;Bit field number(1107)"

See the explanation for error number 1101.

1108 −222,"Data out of range;Query port field(1108)"

If you are using the direct hardware control service feature, you have entered an out of range query address. If this error occurs while not using the direct hardware control service feature, low level hardware drivers could not complete a query. Try setting the synthesizer again. If this error message persists, run the instrument self-test.

1109 1109,"Query Port mode;(1109)"

See the explanation for error number 1108.

1462 1462,"Keybd processor reports status error;(1462)"

A key press was not successful. Try pressing the same key again. If the error message persists, see the explanation for error number 4000.

1463 1463,"Keybd processor data lines incorrect;(1463)"

A key press was not successful. Try pressing the same key again. If the error message persists, see the explanation for error number 4000.

1501 −302,"8673 command not recognized (1501)"

While in HP 8673 emulation mode, an incoming command string was not recognized as being valid. Refer to the front-panel error que for the command sequence.

1511 −301,"8673 command K0 not emulated (1511)"

The above command is recognized by the synthesizer in HP 8673 emulation mode, but it is not emulated. The command is thus discarded and no action is taken. Refer to Chapter 4, "HP 8673 Compatibility Guide" for more information.

1512 −301,"8673 command K1 not emulated (1512)"

The above command is recognized by the synthesizer in HP 8673 emulation mode, but it is not emulated. The command is thus discarded and no action is taken. Refer to Chapter 4, "HP 8673 Compatibility Guide" for more information.

1513 −301,"8673 command Mn not emulated (1513)"

The above command is recognized by the synthesizer in HP 8673 emulation mode, but it is not emulated. The command is thus discarded and no action is taken. Refer to Chapter 4, "HP 8673 Compatibility Guide" for more information.

1514 −301,"8673 command Xn not emulated (1514)"

The above command is recognized by the synthesizer in HP 8673 emulation mode, but it is not emulated. The command is thus discarded and no action is taken. Refer to Chapter 4, "HP 8673 Compatibility Guide" for more information.

1515 −301,"8673 command Wn not emulated (1515)"

The above command is recognized by the synthesizer in HP 8673 emulation mode, but it is not emulated. The command is thus discarded and no action is taken. Refer to Chapter 4, "HP 8673 Compatibility Guide" for more information.

1516 −301,"8673 command BS not emulated (1516)"

The above command is recognized by the synthesizer in HP 8673 emulation mode, but it is not emulated. The command is thus discarded and no action is taken. Refer to Chapter 4, "HP 8673 Compatibility Guide" for more information.

1517 −301,"8673 command L2 not emulated (1517)"

The above command is recognized by the synthesizer in HP 8673 emulation mode, but it is not emulated. The command is thus discarded and no action is taken. Refer to Chapter 4, "HP 8673 Compatibility Guide" for more information.

1518 −301,"8673 command _9 not emulated (1518)"

The above command is recognized by the synthesizer in HP 8673 emulation mode, but it is not emulated. The command is thus discarded and no action is taken. Refer to Chapter 4, "HP 8673 Compatibility Guide" for more information.

1519 −301,"8673 command OC not emulated (1519)"

The above command is recognized by the synthesizer in HP 8673 emulation mode, but it is not emulated. The command is thus discarded and no action is taken. Refer to Chapter 4, "HP 8673 Compatibility Guide" for more information.

1520 −301,"8673 command CT not emulated (1520)"

The above command is recognized by the synthesizer in HP 8673 emulation mode, but it is not emulated. The command is thus discarded and no action is taken. Refer to Chapter 4, "HP 8673 Compatibility Guide" for more information.

1521 −301,"8673 command Nx not emulated (1521)"

The above command is recognized by the synthesizer in HP 8673 emulation mode, but it is not emulated. The command is thus discarded and no action is taken. Refer to Chapter 4, "HP 8673 Compatibility Guide" for more information.

1522 −301,"8673 command SU not emulated (1522)"

The above command is recognized by the synthesizer in HP 8673 emulation mode, but it is not emulated. The command is thus discarded and no action is taken. Refer to Chapter 4, "HP 8673 Compatibility Guide" for more information.

1523 −301,"8673 command SD not emulated (1523)"

The above command is recognized by the synthesizer in HP 8673 emulation mode, but it is not emulated. The command is thus discarded and no action is taken. Refer to Chapter 4, "HP 8673 Compatibility Guide" for more information.

1524 **–301,"8673 command Tx not emulated (1524)"**

The above command is recognized by the synthesizer in HP 8673 emulation mode, but it is not emulated. The command is thus discarded and no action is taken. Refer to Chapter 4, "HP 8673 Compatibility Guide" for more information.

1525 **–301,"8673 command TR not emulated (1525)"**

The above command is recognized by the synthesizer in HP 8673 emulation mode, but it is not emulated. The command is thus discarded and no action is taken. Refer to Chapter 4, "HP 8673 Compatibility Guide" for more information.

1526 **–301,"8673 command RS not emulated (1526)"**

The above command is recognized by the synthesizer in HP 8673 emulation mode, but it is not emulated. The command is thus discarded and no action is taken. Refer to Chapter 4, "HP 8673 Compatibility Guide" for more information.

1527 **–301,"8673 command SM not emulated (1527)"**

The above command is recognized by the synthesizer in HP 8673 emulation mode, but it is not emulated. The command is thus discarded and no action is taken. Refer to Chapter 4, "HP 8673 Compatibility Guide" for more information.

1528 **–301,"8673 command _2 not emulated (1528)"**

The above command is recognized by the synthesizer in HP 8673 emulation mode, but it is not emulated. The command is thus discarded and no action is taken. Refer to Chapter 4, "HP 8673 Compatibility Guide" for more information.

1529 **–301,"8673 command _3 not emulated (1529)"**

The above command is recognized by the synthesizer in HP 8673 emulation mode, but it is not emulated. The command is thus discarded and no action is taken. Refer to Chapter 4, "HP 8673 Compatibility Guide" for more information.

1530 **−301,"8673 command _A not emulated (1530)"**

The above command is recognized by the synthesizer in HP 8673 emulation mode, but it is not emulated. The command is thus discarded and no action is taken. Refer to Chapter 4, "HP 8673 Compatibility Guide" for more information.

1531 **−301,"8673 command SV not emulated (1531)"**

The above command is recognized by the synthesizer in HP 8673 emulation mode, but it is not emulated. The command is thus discarded and no action is taken. Refer to Chapter 4, "HP 8673 Compatibility Guide" for more information.

1532 **−301,"8673 command OL not emulated (1532)"**

The above command is recognized by the synthesizer in HP 8673 emulation mode, but it is not emulated. The command is thus discarded and no action is taken. Refer to Chapter 4, "HP 8673 Compatibility Guide" for more information.

1534 **−301,"8673 command FA not emulated (1534)"**

The above command is recognized by the synthesizer in HP 8673 emulation mode, but it is not emulated. The command is thus discarded and no action is taken. Refer to Chapter 4, "HP 8673 Compatibility Guide" for more information.

1535 **−301,"8673 command FB not emulated (1535)"**

The above command is recognized by the synthesizer in HP 8673 emulation mode, but it is not emulated. The command is thus discarded and no action is taken. Refer to Chapter 4, "HP 8673 Compatibility Guide" for more information.

1536 **−301,"8673 command FS not emulated (1536)"**

The above command is recognized by the synthesizer in HP 8673 emulation mode, but it is not emulated. The command is thus discarded and no action is taken. Refer to Chapter 4, "HP 8673 Compatibility Guide" for more information.

1537 −301,"8673 command DF not emulated (1537)"

The above command is recognized by the synthesizer in HP 8673 emulation mode, but it is not emulated. The command is thus discarded and no action is taken. Refer to Chapter 4, "HP 8673 Compatibility Guide" for more information.

1538 −301,"8673 command DW not emulated (1538)"

The above command is recognized by the synthesizer in HP 8673 emulation mode, but it is not emulated. The command is thus discarded and no action is taken. Refer to Chapter 4, "HP 8673 Compatibility Guide" for more information.

1539 −301,"8673 command SF not emulated (1539)"

The above command is recognized by the synthesizer in HP 8673 emulation mode, but it is not emulated. The command is thus discarded and no action is taken. Refer to Chapter 4, "HP 8673 Compatibility Guide" for more information.

1540 −301,"8673 command SP not emulated (1540)"

The above command is recognized by the synthesizer in HP 8673 emulation mode, but it is not emulated. The command is thus discarded and no action is taken. Refer to Chapter 4, "HP 8673 Compatibility Guide" for more information.

1541 −301,"8673 command IF not emulated (1541)"

The above command is recognized by the synthesizer in HP 8673 emulation mode, but it is not emulated. The command is thus discarded and no action is taken. Refer to Chapter 4, "HP 8673 Compatibility Guide" for more information.

1802 1802,"Low Battery Voltage;(1802)"

The synthesizer battery voltage is low. This could cause loss of RAM data if signal generator power is turned off. Note: Calibration data will never be lost.

1803 **1803,"RAM data lost at power on;(1803)"**

All RAM data was lost. This includes all front panel settings, save/recall registers, level corrections, and other user settable values. This error message can occur when the battery voltage is low, or options change in the synthesizer. Note: Calibration data will never be lost.

1804 **1804,"Self-test failure, run the self-test;(1804)"**

The power-on self-test detected an error or warning. See the explanation for error number 4000.

1805 **1805,"Processor Board or IBUS test Failure;(1805)"**

The power-on self-test detected an error or warning for the microprocessor board circuits or power supply monitors. See the explanation for error number 4000.

1806 **1806,"ROM checksum test failure;(1806)"**

The synthesizer ROM check sum does not match the data in ROM. See the explanation for error number 4000.

1820 **−221,"Settings conflict; PM DEV (1820)"** The PM internal deviation setting was reduced because either:

1. FreqCw was changed into the low band region, or
2. PM internal rate was set above 30 kHz and the PM deviation was above 4 rads.

1821 **−221,"Settings conflict; INT PM FREQ (1821)"**

The PM internal deviation setting was decreased because the PM deviation was increased above 4 rads while the PM internal rate was above 30 kHz.

1822 **−221,"Settings conflict; INT FM DEV (1822)"**

The FM internal deviation setting was reduced because the FreqCw was changed into a

2003 **−222,"Data out of range;CW FREQ(2003)"**

Select a CW frequency that is within range of the installed options. If other modules or options are installed that extend the CW frequency range of the synthesizer, this frequency range will be extended also.

2006 −222,"Data out of range;POWER LEVEL(2006)"

Select a power level within the following ranges:
No attenuator options, −15 dBm to +30 dBm.
Option 1E1, -100 dBm to +30 dBm.

2012 −224,"Illegal parameter value;ALC SOURCE(2012)"

The requested ALC source is not available in the synthesizer. Use *OPT? to check which options are installed.

2015 −222,"Data out of range;SPECIAL(2015)"

Select a special function number that is available in the synthesizer.

2018 −222,"Data out of range;FREQ MULTIPLIER INCR(2018)"

2021 −224,"Illegal parameter value; PULSE PROT STAT (2021)"

This command requires a boolean argument.

Select a frequency multiplier increment from 1 to 99.

2024 −222,"Data out of range;CW FREQ INCR(2024)"

Select a CW frequency increment from 1kHz to 19.99GHz. If other modules or options are installed that extend the CW frequency range of the synthesizer, this frequency range will be extended also. If the 1E8 option is installed the limits will also change to allow for 1 hertz resolution.

2030 −222,"Data out of range;DIRECT HW CONTROL(2030)"

Select synthesizer direct hardware control values within range. See the service manual for more details on this feature.

2033 −222,"Data out of range;POWER LEVEL INCR(2033)"

Select a power level within the following ranges:
No attenuator options, 0.01 dBm to +45 dBm. Option 1E1, 0.01 dBm to +130 dBm.

2036 −222,"Data out of range;EXT METER LEVEL(2036)"

Select an external power meter reading within the following ranges:
No attenuator options, -15 dBm to +30 dBm. Option 1E1, -100 dBm to +30 dBm.

2042 **−222,"Data out of range;DIAG:IBUS:DIR(2042)"**

Correct the HP-IB command DIAG:IBUS:DIR or DIAG:IBUS:DIR? so that its parameters are within their appropriate ranges. See the service manual for more details on this HP-IB only feature.

2045 **-224,"Illegal parameter value; *EMC (2045)"**

This command requires a 1 or 0 as an argument.

2048 **−222,"Data out of range;SYST:KEY(2048)"**

Select a key code available on the synthesizer's front panel.

2051 **−161,"Invalid block data;SYST:SET bad size(2051)"**

The "learn string" sent to the synthesizer is corrupt (incorrect number of bytes). Check that the HP-IB controller is sending the string correctly. In addition, insure that the controller loaded the learn string correctly in the first place. Note: The *LRN? query always returns the same length string regardless of the state of the synthesizer; but, the *LRN? response can change if the firmware version changes.

2054 **−222,"Data out of range;CAL:ALC:CURV(2054)"**

Correct the HP-IB command CAL:ALC:CURV so that its parameters are within the following ranges:
1st parameter: 0.0 to 4.0
2nd parameter: -2.0 to 2.0
3rd-6th parameter: -1.0 to 1.0
7th parameter: 0.0 to 25.0

2057 **−222,"Data out of range;HPIB ADDRESS(2057)"**

Select an HP-IB address for the synthesizer from 0 to 30.

2060 **−222,"Data out of range;SAVE(2060)"**

Select a save state register number from 0 to 9.

2066 **−222,"Data out of range;RECALL(2066)"**

Select a recall state register number from 0 to 9.

2075 **−222,"Data out of range;LO FREQ(2075)"**

Select an LO frequency from 300 MHz to 359.5 MHz.

2078 −222,"Data out of range;OFFSET FREQ(2078)"

Select an offset frequency from 5 MHz to 40 MHz.

2081 −222,"Data out of range;DIAG:FREQ:CYCL(2081)"

Correct the HP-IB command DIAG:FREQ:CYCL so that its parameters are within range. See the service manual for more details on this feature.

2087 −222,"Data out of range;YIG OSC CAL FREQ(2087)"

Correct the HP-IB command CAL:YIG:FREQ:STARt so that its parameter is 2 GHz or 10 GHz.

2090 −222,"Data out of range;CAL:YIG(2090)"

Correct the HP-IB command CAL:YIG[:DATA] so that all of its parameters are from 0 to 65535.

2093 −224,"Illegal parameter value; AM STATE (2093)"

This command requires a boolean argument.

2096 −224,"Illegal parameter value;PULSE TRIG SOUR(2096)"

The requested pulse trigger source is not available in the synthesizer. Use *OPT? to check which options are installed.

2099 −222,"Data out of range;FREQ MULTIPLIER(2099)"

Select a frequency multiplier from 1 to 100.

2102 −222,"Data out of range;EXT METER INCR(2102)"

Select an external power meter reading increment within the following ranges:
No attenuator options, 0.01 dBm to +45 dBm. Option 1E1, 0.01 dBm to +130 dBm.

2105 −222,"Data out of range;CAL:ALC:CURV:FREQ(2105)"

Correct the HP-IB command CAL:ALC:CURVe:FREQuency:STARt so that its parameter is from 10 MHz to 40 GHz. See the service manual for more details on this feature.

2111 -224,"Illegal parameter value; *PSC (2111)"

This command requires a 1 or 0 as an argument.

2114 **−224,"Illegal parameter value;ATTEN LOCK(2114)"**

The HP-IB command "POWer:ATTenuation:AUTO OFF" can only be used if the 1E1 option is installed.

2123 **−222,"Data out of range;PULSE WIDTH(2123)"**

Select a pulse width from 0 to 419ms.

2126 **−222,"Data out of range;PULSE PRI/PRF(2126)"**

Select a pulse repetition interval from 419 ms to a minimum depending on the current carrier frequency or select a pulse repetition frequency from 2.5 Hz to a maximum depending on the current carrier frequency.

2132 **−224,"Illegal parameter value; PULSE STATE (2132)"**

This command requires a boolean argument.

2135 **−224,"Illegal parameter value;EXT PULSE INV(2135)"**

The requested external pulse polarity is not available in the Synthesizer. Use *OPT? to check which options are installed.

2138 **−224,"Illegal parameter value;PULSE SOURCE(2138)"**

If the internal pulse source is not installed in the synthesizer, the HP-IB command PULM:SOURce only allows EXTernal as a parameter.

2144 **−222,"Data out of range;PULSE DELAY(2144)"**

Select a pulse delay from −419 ms to 419 ms. The minimum delay is 0 if external trigger pulse mode is being used.

2147 **-224,"Illegal parameter value; FM STATE (2147)"**

This command requires a boolean argument.

2159 **−224,"Illegal parameter value;AM TYPE(2159)"**

Expected argument is either EXPonential or LINear.

2162 **−222,"Data out of range;CAL:AM:GAIN:OFFS (2162)"**

The value must remain between −128 and +127.

2165 **−224,"Illegal parameter value;REMOTE LANGUAGE(2165)"**

Select an HP-IB remote language which is available in the synthesizer. "SCPI" is the default but others are available as options.

2168 −222,"Data out of range;PULSE DELAY INCR(2168)"

Select a pulse delay increment from 25 ns to 838 ms.

2171 −222,"Data out of range;PULSE WIDTH INCR(2171)"

Select a pulse width increment from 25 ns to 419 ms.

2174 −222,"Data out of range;PULSE PRI/PRF INCR(2174)"

Select a pulse repetition interval increment from 25 ns to 419 ms or select a pulse repetition frequency increment from 1 mHz to 3.3 MHz.

2177 −222,"Data out of range;CAL:FLAT(2177)"

Loss data for factory frequency level correction was out of range.

2180 −224,"Illegal parameter value;FM AC DC(2180)"

Allowable parameter values are AC or DC only.

2189 −224,"Illegal parameter value;DISPLAY STATE(2189)"

The display state could not be set to the state requested.

2192 -224,"Illegal parameter value; LEV CORR STATE (2192)"

This command requires a boolean argument.

2198 −224,"Illegal parameter value;EXT REF(2198)"

The reference oscillator could not be set to INTernal because an internal oscillator does not exist or the reference oscillator could not be set to EXTernal because an external oscillator does not exist.

2210 -222,"Data out of range; ASSembly REVision (2210)"

The value must remain between 0 and +254.

2216 −222,"Data out of range;NODE MEASURE(2216)"

Select a meter node number within range. See the service manual for more details on this feature.

2219 −222,"Data out of range;OPTION WRITE(2219)"

Select an option bit-field number within range. See the service manual for more details on this feature.

2225 **−222,"Data out of range;FM SENSITIVITY(2225)"**

Select an FM sensitivity within its range for the current CW frequency and multiplier.

2231 **−224,"Illegal parameter value;PULSE RISE TIME(2231)"**

The requested pulse rise time is not available in the synthesizer. Use *OPT? to check which options are installed.

2237 **−222,"Data out of range;OFFSET FREQ INCR(2237)"**

Select an offset frequency increment from 1 kHz to 35 MHz. If the 1E8 option is installed the lower limit will change to 1 Hz to allow for 1 Hz resolution.

2240 **−222,"Data out of range;LO FREQ INCR(2240)"**

Select an LO frequency increment from 1 kHz to 359.5 MHz.

2243 **−222,"Data out of range;DIRECT HW CONTROL INC(2243)"**

Select synthesizer direct hardware control increment values within range. See the service manual for more details on this feature.

2249 **−222,"Data out of range;DIAG:ABUS?(2249)"**

Correct the HP-IB query DIAG:ABUS? so that its parameter is within their appropriate range. See the service manual for more details on this HP-IB only feature.

2252 **−222,"Data out of range;CAL:AM:LIN(2252)"**

Correct the HP-IB command CAL:AM:LINear[:DATA] so that all of its parameters are from 0 to 255.

2255 **−222,"Data out of range;CAL:AM:LIN:TABL(2255)"**

Correct the HP-IB command CAL:AM:LINear:TABLe so that its parameter is 1 or 2.

2264 **−222,"Data out of range;CAL:YIG:FM:SENS(2264)"**

Correct the HP-IB command CAL:YIG:FM:SENSitivity so that all of its parameters are from −80 to 80.

2276 −222,"Data out of range;CORR:FLAT(2276)"

Correct the HP-IB command CORRection:FLATness[:DATA] so that all of its frequency parameters are from 1 GHz to 20 GHz and all of its loss parameters are from −40 dB to +40 dB. If other modules or options are installed that extend the frequency range of the synthesizer, this frequency range will be extended also.

2277 2277,"CORR:FLAT cannot query empty table;(2277)"

The selected level correction table data cannot be queried because it is invalid or it does not exist. Check that MEMory:TABLe:SELect is set to a level correction table that has data.

2291 −224,"Illegal parameter value;SERIAL NUM(2291)"

Correct the HP-IB command SYSTem:SNUMber so that its string parameter is 10 characters or less.

2292 −151,"Invalid string data;SERIAL NUM bad char(2292)"

A serial number can only contain characters from ASCII 32 (space) through ASCII 126 (~). However, ASCII 44 (,) and ASCII 59 (;) cannot be used.

2294 −222,"Data out of range;POW METER ADDRESS(2294)"

Select a power meter address for automatic level correction from 0 to 30. Secondary addresses may be allowed in future firmware revisions.

2300 −222,"Data out of range;CAL:FLAT:FREQ:START(2300)"

Correct the HP-IB command CAL:FLATness:FREQuency:STARt so that its parameter is from 10 MHz to 40 GHz. See the service manual for more details on this feature.

2303 −222,"Data out of range;CAL:FLAT:ATT(2303)"

Correct the HP-IB command CAL:FLATness:ATTenuation so that its parameter is from 0 dB to 120 dB with a resolution of 10 dB. See the service manual for more details on this feature.

2306 −222,"Data out of range;CAL:AM(2306)"

Correct the HP-IB command CAL:AM[:DATA] so that all of its parameters are from 0 to 255.

2309 −222,"Data out of range;CAL:AM:FREQ:START(2309)"

Correct the HP-IB command CAL:AM:FREQuency:STARt so that its parameter is from 10 MHz to 40 GHz. See the service manual for more details on this feature.

2444 −222,"Data out of range;LEVEL CORR START FREQ(2444)"

Select an automatic level correction start frequency from 1 GHz to 20 GHz. If other modules or options are installed that extend the CW frequency range of the synthesizer, this frequency range will be extended also.

2447 −222,"Data out of range;LEVEL CORR STOP FREQ(2447)"

Select an automatic level correction start frequency from 1 GHz to 20 GHz. If other modules or options are installed that extend the CW frequency range of the synthesizer, this frequency range will be extended also.

2453 −222,"Data out of range; AM SENSitivity (2453)"

Sensitivity of 30%/Volt or 100%/Volt is allowed in linear mode; −10dB/volt is allowed in log mode.

2457 2457,"RF on before running level correct;(2457)"

The RF must be turned on before running an automatic level correction. Turn RF on and try running the automatic level correction again.

2462 −222,"Data out of range;LEVEL CORR START INC(2462)"

Select an automatic level correction start frequency increment from 1 kHz to 19.99 GHz. If other modules or options are installed that extend the CW frequency range of the synthesizer, this frequency range will be extended also. If the 1E8 option is installed the limits will also change to allow for 1 Hz resolution.

2465 −222,"Data out of range;LEVEL CORR STOP INC(2465)"

Select an automatic level correction stop frequency increment from 1 kHz to 19.99 GHz. If other modules or options are installed that extend the CW frequency range of the synthesizer, this frequency range will be extended also. If the 1E8 option is installed the limits will also change to allow for 1 Hz resolution.

2471 −222,"Data out of range;HPIB ADDRESS INCR(2471)"

Select an HP-IB address increment from 1 to 29.

2474 −222,"Data out of range;YIG OSC CAL FREQ INC(2474)"

Correct the HP-IB command CAL:YIG:FREQuency:STARt:STEP so that its parameter is from 1 GHz to 10 GHz.

2477 −222,"Data out of range;CAL:PULSe:PINCh(2477)"

Correct the HP-IB command CAL:PULSe:PINCh[:DATA] so that all of its parameters are from 0 to 255.

2480 −222,"Data out of range;CAL:PULS:FREQ:START(2480)"

Correct the HP-IB command CAL:PULSe:FREQuency:STARt so that its parameter is 10 MHz.

2522 −222,"Data out of range;POW METER ADDRESS INC(2522)"

Select a power meter address increment from 1 to 29.

2525 −222,"Data out of range;NODE MEASURE INC(2525)"

Select a meter node increment within range.

2531 −222,"Data out of range;LEVEL CORR POINTS(2531)"

Select automatic level correction number of points from 2 to 401.

2534 −222,"Data out of range;LEVEL CORR POINTS INC(2534)"

Select automatic level correction number of points increment from 1 to 401.

2537 −222,"Data out of range;LEVEL CORRECT SAVE(2537)"

Select an automatic level correction register from 1 to 4.

2540 −222,"Data out of range;LEVEL CORR SELECT(2540)"

Select an automatic level correction register from 1 to 4.

2564 −222,"Data out of range; PM:COUP (2564)"

This command requires a boolean argument.

2567 −224,"Illegal parameter value;PULSE RISE TIME(2567)"

The requested pulse rise time is not available in the synthesizer. Use *OPT? to check which options are installed.

2570 −224,"Illegal parameter value;POWERMETER TYPE(2570)"

The selected power type is not supported by the synthesizer.

2576 −224,"Illegal parameter value;PULSE STOP SOUR(2576)"

The requested pulse trigger stop source is not available in the synthesizer. Use *OPT? to check which options are installed.

2579 −224,"Illegal parameter value;TRIG:STOP:SLOP(2579)"

The requested pulse trigger stop slope is not available in the synthesizer. Use *OPT? to check which options are installed.

2582 −222,"Data out of range; PM DEV (2582)"

The internal modulation setting for phase modulation is beyond instrument capabilities. An absolute upper limit of 200 rads is maintained for frequencies above 2 GHz. At lower frequencies, the upper limit is reduced.

2588 −224,"Illegal parameter value;MEM:TABL:SEL(2588)"

Select an automatic level correction register from 1 to 4.

2591 −222,"Data out of range;MEM:TABL:FREQ(2591)"

Correct the HP-IB command MEMory:TABLe:FREQuency so that all of its parameters are from 1 GHz to 20 GHz. If other modules or options are installed that extend the frequency range of the synthesizer, this frequency range will be extended also.

2592 2592,"MEM:TABL:FREQ cannot query empty table;(2592)"

The selected level correction table data cannot be queried because it is invalid or it does not exist. Check that MEMory:TABLe:SELect is set to a level correction table that has data.

2597 −222,"Data out of range;MEM:TABL:LOSS(2597)"

Correct the HP-IB command MEMory:TABLe:LOSS[:MAGnitude] so that all of its parameters are from -40 dB to +40 dB.

2598 2598,"MEM:TABL:LOSS cannot query empty table;(2598)"

The selected level correction table data cannot be queried because it is invalid or it does not exist. Check that MEMory:TABLe:SELect is set to a level correction table that has data.

2612 **–224,"Illegal parameter value;FM SOURCE(2612)"**

The allowable arguments are EXTernal, FEED, or INTernal. FEED and INTernal are only allowed when Option 1E2 (internal modulation) is installed.

2615 **–222,"Data out of range;INT FM FREQ(2615)"**

Select an internal FM frequency (rate) from 0.5 Hz to 1 MHz.

2618 **–222,"Data out of range;INT FM FREQ INC(2618)"**

Select an internal FM frequency (rate) increment from 0.5Hz to 999.9995kHz.

2621 **–222,"Data out of range;INT FM DEV(2621)"**

Select an internal FM deviation from 0Hz to 10MHz.

2624 **–222,"Data out of range;INT FM DEV INC(2624)"**

Select an internal FM deviation increment from 0.01Hz to 10MHz.

2627 **–224,"Illegal parameter value;FM:FEED(2657)"**

Change the FM:FEED input parameter to a source that is available in the synthesizer.

2633 **–224,"Illegal parameter value; PM STATE (2633)"**

This command requires a boolean argument, or phase modulation is not possible on this instrument, or the phase modulation option is not installed.

2636 **–224,"Illegal parameter value; PM SOURCE (2636)"**

The allowable arguments are EXTernal, FEED, or INTernal. FEED and INTernal are only allowed when the Option 1E2 (internal modulation) is installed.

2639 **–222,"Data out of range; FM SENS (2639)"**

The requested sensitivity exceeds the capabilities of the instrument at the current FREQuencyCW. The limitation of FmSens are dependent upon FREQuencyCW.

2642 **–224,"Illegal parameter value;AM SOURCE(2642)"**

The allowable arguments are EXTernal, FEED, or INTernal. FEED and INTernal are only allowed when Option 1E2 (internal modulation) is installed.

2645 **–222,"Data out of range;INT AM FREQ(2645)"**

Select an internal AM frequency (rate) from 0.5 Hz to 20 kHz.

2648 **–222,"Data out of range;INT AM FREQ INC(2648)"**

Select an internal AM frequency (rate) increment from 0.5 Hz to 20 kHz.

2651 **–222,"Data out of range;INT AM DEPTH(2651)"**

In log mode, the data value must be between 0 dB and 60 dB. In linear mode, the data value must be between 0% and 100%.

2654 **–222,"Data out of range;INT AM DEPTH INC(2654)"**

In log mode, the data value must be between .01 dB and 60 dB. In linear mode, the data value must be between 0.1% and 100%.

2657 **–224,"Illegal parameter value;AM:FEED(2657)"**

Change the AM:FEED input parameter to a source that is available in the synthesizer.

2660 **–222,"Data out of range; INT PM DEV INC (2660)"**

The value must remain between .01 rads and 10.0 rads.

2663 **–222,"Data out of range; INT PM FREQ (2663)"**

The value must remain between 0.5 Hz and 1 MHz, except when PM:RANG:AUTO is set to HIGH. In this case, the value will be restricted to a value between 0.5 Hz and 30 kHz.

2666 **–222,"Data out of range; INT PM FREQ INC (2666)"**

The value must remain between 0.5 Hz and 999.9995 kHz.

2672 **–222,"Data out of range;CAL:MODS:AM(2672)"**

Correct the HP-IB command CAL:MODS:AM[:DATA] so that all of its parameters are from 0 to 255.

2678 **−222,"Data out of range;CAL:MODS:FM(2678)"**

Correct the HP-IB command CAL:MODS:FM[:DATA] so that all of its parameters are from 0 to 255.

2702 **−222,"Data out of range;ADD OPTION(2702)"**

Select an option bit number within range. See the service manual for more details on this feature.

2705 **−222,"Data out of range;DELETE OPTION(2705)"**

Select an option bit number within range. See the Service Manual for more details on this feature.

3500 **−221,"Settings conflict;PULSE DELAY(3500)"**

The current pulse delay value was changed because the pulse delay limits changed for the current pulse mode. For example, if pulse delay is −100 ms and the synthesizer is placed into external trigger mode, this error will be reported and the pulse delay will be set to 0 ms.

4000 **−330,"Self-test failed;(4000)"**

Run the instrument self-test a couple times, checking the error queue each time the self-test is run. If the error message persists, use the ERASE MEMORY feature, press the preset key and cycle the power; try the self-test again. If the error message persists, an instrument failure may have occurred and servicing may be required. If the synthesizer is functioning to your satisfaction, you may wish to ignore the error message.

4001 **−330,"Self-test failed;(4001)"**

See the explanation for error number 4000.

4002 **−330,"Self-test failed;(4002)"**

See the explanation for error number 4000.

4003 **−330,"Self-test failed;(4003)"**

See the explanation for error number 4000.

4004 **−330,"Self-test failed;(4004)"**

See the explanation for error number 4000.

4005 −330,"Self-test failed;(4005)"

See the explanation for error number 4000.

4006 −330,"Self-test failed;(4006)"

See the explanation for error number 4000.

4007 −330,"Self-test failed;(4007)"

See the explanation for error number 4000.

4008 −330,"Self-test failed;(4008)"

See the explanation for error number 4000.

4009 −330,"Self-test failed;(4009)"

See the explanation for error number 4000.

4010 −330,"Self-test failed;(4010)"

See the explanation for error number 4000.

4011 −330,"Self-test failed;(4011)"

See the explanation for error number 4000.

4012 −330,"Self-test failed;(4012)"

See the explanation for error number 4000.

4013 −330,"Self-test failed;(4013)"

See the explanation for error number 4000.

4014 −330,"Self-test failed;(4014)"

See the explanation for error number 4000.

4015 −330,"Self-test failed;(4015)"

See the explanation for error number 4000.

4016 −330,"Self-test failed;(4016)"

See the explanation for error number 4000.

4017 −330,"Self-test failed;(4017)"

See the explanation for error number 4000.

4018 −330,"Self-test failed;(4018)"

See the explanation for error number 4000.

4019 −330,"Self-test failed;(4019)"

See the explanation for error number 4000.

4020 −330,"Self-test failed;(4020)"

See the explanation for error number 4000.

4021 −330,"Self-test failed;(4021)"

See the explanation for error number 4000.

4022 −330,"Self-test failed;(4022)"

See the explanation for error number 4000.

4023 −330,"Self-test failed;(4023)"

See the explanation for error number 4000.

4024 −330,"Self-test failed;(4024)"

See the explanation for error number 4000.

4025 −330,"Self-test failed;(4025)"

See the explanation for error number 4000.

4026 −330,"Self-test failed;(4026)"

See the explanation for error number 4000.

4027 −330,"Self-test failed;(4027)"

See the explanation for error number 4000.

4028 −330,"Self-test failed;(4028)"

See the explanation for error number 4000.

4029 −330,"Self-test failed;(4029)"

See the explanation for error number 4000.

4030 −330,"Self-test failed;(4030)"

See the explanation for error number 4000.

4031 −330,"Self-test failed;(4031)"

See the explanation for error number 4000.

4032 −330,"Self-test failed;(4032)"

See the explanation for error number 4000.

4033 −330,"Self-test failed;(4033)"

See the explanation for error number 4000.

4034 −330,"Self-test failed;(4034)"

See the explanation for error number 4000.

4035 −330,"Self-test failed;(4035)"

See the explanation for error number 4000.

4036 −330,"Self-test failed;(4036)"

See the explanation for error number 4000.

4037 −330,"Self-test failed;(4037)"

See the explanation for error number 4000.

4038 −330,"Self-test failed;(4038)"

See the explanation for error number 4000.

4039 −330,"Self-test failed;(4039)"

See the explanation for error number 4000.

4040 −330,"Self-test failed;(4040)"

See the explanation for error number 4000.

4041 −330,"Self-test failed;(4041)"

See the explanation for error number 4000.

4042 −330,"Self-test failed;(4042)"

See the explanation for error number 4000.

4043 −330,"Self-test failed;(4043)"

See the explanation for error number 4000.

4044 −330,"Self-test failed;(4044)"

See the explanation for error number 4000.

4045 −330,"Self-test failed;(4045)"

See the explanation for error number 4000.

9000 −330,"Self-test failed;(9000)"

See the explanation for error number 4000.

4

HP 8673 Compatibility Guide

HP 8673 Compatibility Guide

This chapter contains information pertaining to the HP 8673 compatibility with SCPI commands. In addition, information about special considerations and status bits is provided in this chapter.

In Table 4-1, each HP 8673 command is listed along with its associated parameter and equivalent SCPI command (if one exists). Numbers referring to specific notes are also listed in the table. The corresponding notes follow the table.

Table 4-1. HP 8673 Command Mapping to SCPI Commands

HP 8673 Command	Parameter	Equivalent SCPI Command	See Note
AP	Level	POW:IMM	
A0, A0	AM OFF	AM:STAT OFF	
A1	AM OFF	AM:STAT OFF	
A2	AM 30%	AM:SOUR EXT; TYPE LIN; SENS 30; STAT ON	11
A3	AM 100%	AM:SOUR EXT; TYPE LIN; SENS 100; STAT ON	11
BS	Backspace	Not emulated	1
BY	ByPass mode	No action	
CF	Center frequency	FREQ:CW	
CS	Clear status	*CLS	
CT	Configure trig	Not emulated	1
CW	CW frequency	FREQ:CW	
C1	ALC INTERNAL	POW:ALC INT	
C2	ALC DIODE	POW:ALC DIOD	
C3	ALC PWR MTR	POW:ALC PMET	
C4	ALC SYS mode	POW:ALC PMET	
DB	dB	dB or dBm	
DF	Delta frequency	Not emulated	1
DM	dB	dB or dBm	
DN	FREQ INC (Down)	FREQ:CW DOWN	
DW	DWELL	Not emulated	1
D0, D0	FM DEVIATION OFF	FM:STAT OFF	
D1	FM DEVIATION OFF	FM:STAT OFF	

Table 4-1. HP 8673 Command Mapping to SCPI Commands (continued)

HP 8673 Command	Parameter	Equivalent SCPI Command	See Note
D2	FM DEVIATION .03 MHz	FM:SOUR EXT; SENS 30KHZ/V; STAT ON	2
D3	FM DEVIATION .1 MHz	FM:SOUR EXT; SENS 100KHZ/V; STAT ON	2
D4	FM DEVIATION .3 MHz	FM:SOUR EXT; SENS 300KHZ/V; STAT ON	2
D5	FM DEVIATION 1 MHz	FM:SOUR EXT; SENS 1MHZ/V; STAT ON	2
D6	FM DEVIATION 3 MHz	FM:SOUR EXT; SENS 3MHZ/V; STAT ON	2
D7	FM DEVIATION 10 MHz	FM:SOUR EXT; SENS 10MHZ/V; STAT ON	2
FA	START sweep frequency	Not emulated	1
FB	STOP sweep frequency	Not emulated	1
F1, FI	FREQ INCR	FREQ:STEP	
FN	FREQ INCR	FREQ:STEP	
FO	+OFFSET	FREQ:OFFS	
FO—	—OFFSET	FREQ:OFFS	
FR	FREQUENCY	FREQ:CW	
FS	Delta frequency	Not emulated	1
FT	+OFFSET	FREQ:OFFS	
FT—	—OFFSET	FREQ:OFFS	
GZ	GHz	GHz	
HZ	Hz	HZ	
IF	Increment frequency (Sweep)	Not emulated	1
IP	Instrument preset	*RST	7
KZ	kHz	KHZ	
K0	AUTO PEAK OFF	Not emulated	1
K1	AUTO PEAK ON	Not emulated	1
K2	AUTO PEAK	Not emulated	1

Table 4-1. HP 8673 Command Mapping to SCPI Commands (continued)

HP 8673 Command	Parameter	Equivalent SCPI Command	See Note
LE	Power level	POW:IMM	
L1	Front panel Learn mode	Not emulated	1
L2	Special Fcn learn mode	Not emulated	1
MG	MESSAGE	DIAG_MG	5
MS	Milliseconds	MS	
MU	MULT	FREQ:MULT	
MY	MULT	FREQ:MULT	
MZ	MHz	MHZ	
M0,M0	Marker(s) OFF	Not emulated	1
M1	Marker 1	Not emulated	1
M2	Marker 2	Not emulated	1
M3	Marker 3	Not emulated	1
M4	Marker 4	Not emulated	1
M5	Marker 5	Not emulated	1
N0,N0	TUNE knob OFF	Not emulated	1
N1	TUNE knob ON	Not emulated	1
NM	Normal mode	No action	
OA	Output active parameter	DIAG:OA?	6
OC	Output coupled	Not emulated	1
OK	Output lock freq	FREQ:CW?	
OL	Front panel learn mode	Not emulated	1
OR	Output request mask	*SRE?	9
OS	Output status	DIAG:OS	4
PL	Power level	POW:IMM	

Table 4-1. HP 8673 Command Mapping to SCPI Commands (continued)

HP 8673 Command	Parameter	Equivalent SCPI Command	See Note
P0,P0	PULSE OFF	PULM:SOUR EXT; STAT OFF	
P1	PULSE OFF	PULM:SOUR EXT; STAT OFF	
P2	PULSE NORM	PULM:SOUR EXT; POL NORM; STAT ON	
P3	PULSE COMP	PULM:SOUR EXT; POL INV; STAT ON	
RA	RANGE	Mapped to PL	10
RC	Recall	*RCL	3
RCBS	Alternate IP	*RST; CW 14GHZ	8
RD	RANGE	Not emulated	1
RF0	RF OFF	POW:STAT OFF	
RF1	RF ON	POW:STAT ON	
RL	Recall	*RCL	3
RM	RQS mask	*SRE	9
RS	Reset sweep	Not emulated	1
RU	RANGE UP 10 dB	POW:IMM:STEP 10db; :POW:IMM UP	
R0	RF OFF	POW:STAT OFF	
R1	RF ON	POW:STAT ON	
SD	Slave down	Not emulated	1
SF	STEP	Not emulated	1
SH	Shift	No action	
SHC2	ALC SYS mode	POW:ALC PMET	
SM	MANUAL sweep	Not emulated	1
SP	STEP	Not emulated	1
SS	Steps (suffix)	No action	
ST	Store	*SAV	

Table 4-1. HP 8673 Command Mapping to SCPI Commands (continued)

HP 8673 Command	Parameter	Equivalent SCPI Command	See Note
SU	Slave UP	Not emulated	1
SV	Service function	Not emulated	1
TI	Test interface	*TST?	
TR	Execute trigger	Not emulated	1
T1	Meter LVL	Not emulated	1
T2	Meter AM	Not emulated	1
T3	Meter FM	Not emulated	1
UP	FREQ INCR (up)	FREQ:CW UP	
VE	VERNIER	Mapped to PL	10
W0,W0	SWEEP MODE OFF	Not emulated	1
W1	SWEEP MODE OFF	Not emulated	1
W2	AUTO sweep	Not emulated	1
W3	MANUAL sweep	Not emulated	1
W4	SINGLE sweep	Not emulated	1
W5	SINGLE sweep: arm only	Not emulated	1
W6	SINGLE sweep: arm and	Not emulated	1
W7	Master sweep	Not emulated	1
W8	Slave sweep	Not emulated	1
XF	XFREQ	No action	

Table 4-1. HP 8673 Command Mapping to SCPI Commands (continued)

HP 8673 Command	Parameter	Equivalent SCPI Command	See Note
X0,X0	Marker(s) OFF	Not emulated	1
X1	Marker 1	Not emulated	1
X2	Marker 2	Not emulated	1
X3	Marker 3	Not emulated	1
X4	Marker 4	Not emulated	1
X5	Marker 5	Not emulated	1
Y0	FREQ display off	DISP:STAT OFF	
Y1	FREQ display on	DISP:STAT ON	
@A	Start of FP learn mode	Not emulated	1
@1	Prefix for request mask	*SRE	9
@2	Deferred execution mode	Not emulated	1
@3	Immediate execution mode	Not emulated	1
@9	Start of special function learn mode	Not emulated	1
SCPI	Change to SCPI	SYST:LANG SCPI	
SE	Output error string	SYST:ERR?	

Notes:

Note 1 The command is accepted, but front panel and remote error messages are given specifying that this command is not emulated.

Note 2 For CW frequencies above 1 GHz, available sensitivities are as shown. When the CW frequency is below 1 GHz, sensitivity is reduced by factors of four at logarithmic intervals (see the command FM:DEV in an earlier SCPI section). For HP 83711A/12A model synthesizers, only 5 MHz/Volt is available at 1 GHz and above. In addition, HP 83711A/12A model synthesizers have reduced sensitivities for CW frequencies below 1 GHz.

Note 3 Recall register 0 is equivalent to an instrument preset (IP).

Note 4 The OS command is only available in HP 8673 compatibility mode. Although the HP 8673 specifies that two binary bytes will be returned on the bus, in some cases only one byte is returned. The HP 837xx synthesizers always return two binary bytes (status + extended) plus a line-feed character.

Note 5 The MG command typically returns a +<digit>, or a +<digit><digit> instead of the HP 8673 fixed format of <digit><digit>. The error message numbers are similar to those of an HP 8673. For any significant development and debugging work, it is recommended that the string query command "SE" (SYSTem:ERRor) be used for a more accurate detailed error message.

Note 6 This command is not accessible through normal SCPI. When either freqMult != 1 or freqOffset != 0, the output of the frequency parameter becomes a variable format instead of a fixed precision format of 11 digits.

Note 7 Except for power level and sweep parameters that are not emulated, all parameters as specified on page 3-121 of the HP 8673B User's Guide are the same. The power level after an instrument preset (IP) will be the lowest available depending upon model and options.

Note 8 The RCBS command is mapped to an instrument preset (IP), except with the addition of setting the frequency to 14 GHz. The frequency multiply and ALC modes are not preserved.

Note 9 This command has the same functionality as the SCPI feature *SRE; however, set and query forms are a single byte of binary data as in the HP 8673B.

Note 10 The RA (Range) and "VE" (Venier) commands emulate, in most cases, the personality of the 8673. Some differences are:

- RA does NOT map directly into the attenuator state. The synthesizer has different attenuator band cross points than the 8673. In addition, these band cross points are instrument state dependent. See Linear AM mode of the main manual. However, the desired power level will be delivered.
- The preferred range of "VE" is from −10 to 0. Values outside this range will be accepted. "VE" and "RA" may change values at a warm power up, register recall, and learn string except, however, their sum will remain the same in such transitions.

Note 11 Commands A2 and A3 are mapped to :AM:SOUR EXT; STAT ON for HP 83711A/12A Synthesizers. Linear modulation is not available on HP 83711A/12A and HP 83711B/12B Synthesizers.

Note 12 The SCPI version of learn strings is operated through this command. However, an approximately 4200 byte string is required instead of a 96 byte string. Imbedded in the string, the initial sequence will be ":SYSTEM:SET . . . " instead of "@A": this should make no difference to the user. The following RMB program is an example of usage:

```
10   DIM A$ [5000]
20   OUTPUT 719;"L1"
30   ENTER 719 USING "-K";A$
40   PRINT "String Read"
50   PAUSE
60   !
70   PRINT "Sending String"
80   OUTPUT 719;A$
90   END
```

Note 13 Supplemental commands to 8673 that allow some key needed functionality.

Note 14 The HP 83711A/12A and HP 83711B/12B synthesizers do not support modulation. Therefore, the following HP 8673 commands will produce an "Undefined Header" error message if sent:

Amplitude Modulation	A0, AO, A1, A2, A3
Frequency Modulation	DO, D0, D1, D2, D3, D4, D5, D6, D7
Pulse Modulation	PO, P0, P1, P2, P3

Out of Range Personality Difference

The HP synthesizers limit a command argument to the closest allowable value; the HP 8673 rejects an out of range command and will not change the current state value.

Rounding Personality Difference

The HP synthesizers generally round numbers according to IEEE rules; the HP 8673 rounds numbers down to a more negative value.

Out of Range

The HP synthesizers limit a command argument to the closest allowable value; the HP 8673 rejects an out of range command and will not change the current state value.

Rounding

The HP synthesizers generally round numbers according to IEEE rules; the HP 8673 rounds numbers down to a more negative value.

Power Suffixes

Power suffixes dB or dBm are generally accepted for all power level commands.

Output Active Parameter

The active parameter is not coordinated with the front panel.

System ALC Mode

The C4 (system ALC mode) is mapped to the ALC:SOUR PMETer command.

NOTE

In this mode, POW:LEV is set to the value of POW:ALC:PMET[:LEV]. Also, leveling is expected at the ALC IN connector of 0 V = 0 dBm.

Query Return Format

The query return format, from a synthesizer product in HP 8673 emulation mode, can have significant differences. In particular, the synthesizer products will ALWAYS follow every query return string with a "line feed" (i.e., 0x0A). This can cause problems, especially when RMB code has been specifically tuned to the two byte binary format return of the HP 8673 "OS" command. It will be a common problem for existing programs to leave this third byte (i.e., line feed) in the output queue. This will eventually produce a "−410 query interrupted" error when any next command is sent.
If a current RMB program has the following commands:

```
OUTPUT 719 USING "2A";"OS"
ENTER 719 USING "%,B,B";Stat1,Stat2
```

It is recommended to add an extra query byte variable to handle this carriage return.

```
OUTPUT 719 USING "2A";"OS"
ENTER 719 USING "%,B,B,B";Stat1,Stat2,Extra
```

HP 8673 Status Bits

This section describes the HP 8673 status and extended bytes.

Images

Table 4-2. HP 8673 Status and Extended Bytes

Byte	Weight	Description	HP 8673
Status Byte			
Bit 1	1	Front panel key pressed	Front panel key pressed
Bit 2	2	Operation complete	Front panel entry complete
Bit 3	4	Change in ESB	Change in ESB
Bit 4	8	Source settled	Source settled
Bit 5	16	0	End of sweep
Bit 6	32	Command error	Entry error
Bit 7	64	RQS bit request service	RQS bit request service
Bit 8	128	0	Change in sweep parameter
Extended Byte			
Bit 1	1	0	Self test failed
Bit 2	2	Modulation error	FM over modulation
Bit 3	4	0	0
Bit 4	8	0	External reference
Bit 5	16	Frequency error	Not phased locked
Bit 6	32	0	Power failure / on
Bit 7	64	ALC unleveled	ALC unleveled
Bit 8	128	0	

Event Register Bits

The status byte is an event register. Bits are set when the event occurs, and cleared only when read with the OS command.

Condition Register Bits

The extended status byte is a condition register. Bits are set and cleared with the condition.

Source Settled Bit Personality Difference

The HP 837XXX synthesizers set the source settled bit (bit 4 of the primary status byte) anytime a parameter is changed that effects conditions at the RF output. The HP 8673 source settled bit applies primarily to changes in power level.

ALC Unleveled and Frequency Error Bits

When the RF is turned off on the HP 8673, the ALC unleveled and frequency error extended status bits are set. This condition does not occur on the HP 837XXX synthesizers.

Change in ESB Bit

The change in ESB bit for the HP 837XXX synthesizers will only be turned on when any bit of the extended byte becomes true; not when any bit becomes false as in the HP 8673.

Front Panel Entry Complete Bit

The HP 8673 front panel entry complete bit, in remote programming mode, applies only to changes in frequency increment, offset, multiply, and in some command argument out of limit conditions. For HP 837XXX compatibility, the status "Operation Complete" is mapped to this bit.

5

Legal and Regulatory Information

Legal and Regulatory Information

This chapter contains information pertaining to SCPI conformance and the warranty.

SCPI Conformance

The synthesizer uses the SCPI (Standard Commands for Programmable Instruments) language for HP-IB communication. The SCPI commands and queries that the synthesizer understands are listed and described individually in Chapter 2, "Programming Commands".

Table 5-1 lists all of the commands and queries that the synthesizer understands and whether they are SCPI approved, SCPI confirmed, or non-SCPI. The commands and queries that are labeled "IEEE 488.2 Required" and "IEEE 488.2 Optional" are also non-SCPI.

NOTE

In the table, if a command is terminated with a question mark enclosed in parentheses (?), that particular syntax is both a command and a query.

The SCPI version number that the synthesizer supports at the writing of this manual is 1992.0. Use SYST:VERS? to find the current version of the signal generator.

If you need more information about SCPI, refer to the Beginner's Guide to SCPI (HP part number 5010-7166) by Barry Eppler.

Table 5-1. SCPI Conformance

Programming Command	Status
*CLS	IEEE 488.2 Required
DISPlay[:WINDow][:STATe][?]	SCPI Confirmed
*DMC	IEEE 488.2 Optional
*EMC[?]	IEEE 488.2 Optional
*ESE[?]	IEEE 488.2 Required
*ESR?	IEEE 488.2 Required
*GMC?	IEEE 488.2 Optional
*IDN?	IEEE 488.2 Required
*LMC?	IEEE 488.2 Optional
*LRN?	IEEE 488.2 Optional
MEMory:CATalog[:ALL]	SCPI-Confirmed
MEMory:CATalog:TABLe	SCPI-Confirmed
MEMory:CATalog:MACRo	SCPI-Confirmed
MEMory:RAM:INITialize	Non-SCPI
MEMory:TABLe:SELect[?]	SCPI-Confirmed
MEMory:TABLe:FREQuency[?]	SCPI-Confirmed
MEMory:TABLe:FREQuency:POINts?	SCPI-Confirmed
MEMory:TABLe:LOSS[:MAGNitude][?]	SCPI-Confirmed
MEMory:TABLe:LOSS[:MAGNitude]:POINts?	SCPI-Confirmed
*OPC[?]	IEEE 488.2 Required
*OPT?	IEEE 488.2 Optional
OUTPut:IMPedance?	SCPI Confirmed
OUTPut:PROTection[:STATe][?]	SCPI Confirmed
OUTPut[:STATe][?]	SCPI Confirmed
*PMC	IEEE 488.2 Optional

Table 5-1. SCPI Conformance (continued)

Programming Command	Status
*PSC(?)	IEEE 488.2 Optional
*RCL	IEEE 488.2 Optional
*RMC	IEEE 488.2 Optional
*RST	IEEE 488.2 Required
*SAV	IEEE 488.2 Optional
[SOURce[1]:]CORRection:FLATness[:DATA]	SCPI Confirmed
[SOURce[1]:]CORRection:FLATness:POINts	SCPI Confirmed
[SOURce[1]:]CORRection[:STATe](?)	SCPI Confirmed
[SOURce[1]:]CORRection:CSET[:SELect](?)	SCPI Confirmed
[SOURce[1]:]CORRection:CSET:STATe(?)	SCPI Confirmed
[SOURce[1]:]FREQuency[:CW|:FIXed](?)	SCPI Confirmed
[SOURce[1]:]FREQuency[:CW|:FIXed]:STEP(?)	SCPI Confirmed
[SOURce[1]:]FREQuency:MULTiplier(?)	SCPI Confirmed
[SOURce[1]:]FREQuency:MULTiplier:STEP(?)	SCPI Confirmed
[SOURce[1]:]POWer:ALC:PMETer(?)	Non-SCPI
[SOURce[1]:]POWer:ALC:PMETer:STEP(?)	Non-SCPI
[SOURce[1]:]POWer:ALC:SOURce(?)	SCPI Confirmed
[SOURce[1]:]POWer:ATTenuation:AUTO(?)	SCPI Confirmed
[SOURce[1]:]POWer[:LEVel](?)	SCPI Confirmed
[SOURce[1]:]POWer[:LEVel]:STEP(?)	SCPI Confirmed
[SOURce[1]:]ROSCillator:SOURce?	SCPI Confirmed
*SRE(?)	IEEE 488.2 Required
STATus:OPERation:CONDition?	SCPI Confirmed
STATus:OPERation:ENABLe(?)	SCPI Confirmed
STATus:OPERation[:EVENt]?	SCPI Confirmed

Table 5-1. SCPI Conformance (continued)

Programming Command	Status
STATus:OPERation:NTRansition(?)	SCPI Confirmed
STATus:OPERation:PTRansition(?)	SCPI Confirmed
STATus:PRESet	SCPI Confirmed
STATus:QUEStionable:CONDition?	SCPI Confirmed
STATus:QUEStionable:ENABle(?)	SCPI Confirmed
STATus:QUEStionable[:EVENt]?	SCPI Confirmed
STATus:QUEStionable:NTRansition(?)	SCPI Confirmed
STATus:QUEStionable:PTRansition(?)	SCPI Confirmed
*STB?	IEEE 488.2 Required
SYSTem:COMMunicate:GPIB:ADDRess(?)	SCPI Confirmed
SYSTem:COMMunicate:PMETer:ADDRess(?)	Non-SCPI
SYSTem:ERRor?	SCPI Confirmed
SYSTem:KEY(?)	SCPI Confirmed
SYSTem:LANGuage(?)	SCPI Confirmed
SYSTem:PRESet	SCPI Confirmed
SYSTem:VERSion?	SCPI Confirmed
*TST?	IEEE 488.2 Required
UNIT:FREQuency(?)	SCPI Confirmed
UNIT:POWer|:VOLTage(?)	SCPI Confirmed
*WAI	IEEE 488.2 Required

Certification

Hewlett-Packard Company certifies that this product met its published specifications at the time of shipment from the factory. Hewlett-Packard further certifies that its calibration measurements are traceable to the United States National Institute of Standards and Technology, (NIST), to the extent allowed by the Institute's calibration facility, and to the calibration facilities of other International Standards Organization members.

Regulatory Information

The declaration of conformity can be found in the user's guide and the calibration guide for this instrument.

Warranty

This Hewlett-Packard instrument product is warranted against defects in material and workmanship for a period of one year from date of shipment. During the warranty period, Hewlett-Packard Company will, at its option, either repair or replace products which prove to be defective.

For warranty service or repair, this product must be returned to a service facility designated by HP. Buyer shall prepay shipping charges to HP and HP shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to HP from another country. HP warrants that its software and firmware designated by HP for use with an instrument will execute its programming instructions when properly installed on that instrument. HP does not warrant that the operation of the instrument, or software, or firmware will be uninterrupted or error free.

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